ILLUSTRATED
ELECTRICAL REVIEW
A Journal of Scientific and Electrical Progress.

VOL. 30. No. 10. WEEKLY. | NEW YORK, WEDNESDAY, MARCH 10, 1897. | $3 PER ANNUM. Single Copies, 10 Cents.

Copyright, 1897, by ELECTRICAL REVIEW PUBLISHING COMPANY, Times Building, 41 Park Row, New York. Entered at Post Office, New York, as Mail Matter of the Second Class.

VIEWS, NEWS AND INTERVIEWS.

"The specifications for insulated wire used for telephonic purposes by the larger telephone companies are so severe in their requirements that only a few of the wire manufacturers care to bid for this class of work," said an old-timer. "It occurs to me that, if the telephone companies find it necessary to adopt such rigid specifications, it is all the more important for electric light and railway companies to adopt a similar course."

As the result of an extensive inquiry into various methods of electric traction, it is proposed to adopt, at any rate tentatively, the overhead system on the Sheffield, Eng, municipal electric railway system.

"I think I have discovered at least one reason why there is apparently so long delay in handing down the Berliner decision by the Supreme Court," remarked an observing man. "If you will remember, Mr. Causten Brown, in his argument before the Supreme Court, emphasized the fact that in the brief submitted by the American Bell Telephone Company there were 275 citations. When you bear this fact in mind, and also the fact that the Justice writing the opinion must verify these citations, it goes a long way with me toward explaining the apparent delay in rendering the decision."

Robert H. Furman recently obtained a verdict of $9,000 against the Brooklyn Heights Railroad Company, of Brooklyn, N. Y. He was a conductor employed by the company, and in a rear-end collision received a fracture of the left leg.

"If every one of our subscribers," remarked a wide-awake telephone manager of a big western city, "was to wake up to-morrow morning and determine to make one additional call over the telephone, it would cost us $10,000 per annum for the increased number of telephone operators required, to say nothing of the other expenses." Then the said manager proceeded to draw a diagram showing the increase of telephone calls on rainy days and half-holidays, as convincing proof of the popularity of this means of communication on such occasions.

According to a steam railroad paper, Dr. George R. Weist, surgeon of the Pennsylvania lines at Richmond, Ind., in a paper on malingering, recently read before a literary society in that city, states that he learns, on good authority, that the railroads of England, in a period of five years, paid out $11,000,000 to persons claiming to have been suffering from spinal injuries received while traveling on the cars; and that a large part of the claims represented in this immense sum were based on pure malingering—lying to get money. Dr. Weist estimates that in the same time probably more than the sum named is paid out by the railroads of the United States for fictitious injuries. Many of our electric railway companies could doubtless relate experiences in this direction.

Electric traction is likely to bring about a number of changes in the Copenhagen tramway system, which is one of the best worked and most remunerative in existence, says London *Engineering*. Nearly all the companies are, and have been for a series of years, paying high dividends, and now, when the concession expires, or the companies are being transferred, the shareholders are receiving excellent prices for their shares. In one case 300 per cent has been paid for a company's assets when the concession was expiring, and now an electrical syndicate has offered another 200 per cent for their concern.

The Consolidated Traction Company, of New Jersey, has brought action in the Court of Chancery at Newark to restrain the Howard Savings Institution from paying $1,400 to Frank Dutton, a former conductor upon the line. The company alleges that the money is part of the plunder obtained in an organized scheme of robbery by means of fraudulent transfer tickets. Dutton's lawyer asserted that all but $100 of the money belonged to Dutton's wife, and that $500 was deposited in the bank before he was employed by the company.

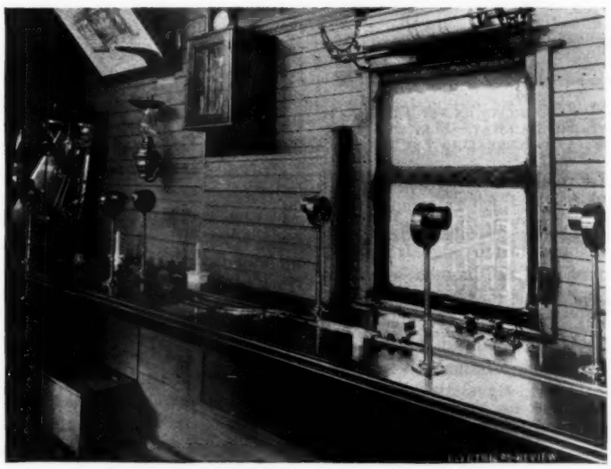


FIG. 1.—ELECTRICITY ON THE CINCINNATI SOUTHERN RAILWAY.—INTERIOR VIEW OF INSTRUCTION CAR, SHOWING MODELS OF AUTOMATIC ELECTRIC SIGNALS.

Laconia Car Company.

The entire plant of the Laconia Car Company at Laconia, N. H., has been sold at private sale to F. Jones, of Portsmouth, and E. H. Gilman, of Exeter, representing a new corporation.

ELECTRICITY ON THE CINCINNATI SOUTHERN RAILWAY.

ELECTRIC SIGNALS, ELECTRIC LIGHTS, HEADLIGHTS, ETC., ON A PROMINENT SOUTHERN ROAD.

The Cincinnati Southern Railway, which is a leased line of the Cincinnati, New Orleans & Texas Pacific Railway, and forms an important part of what is known as the "Queen & Crescent Route," extends almost due south from Cincinnati, Ohio, to Chattanooga, Tenn. The "Queen & Crescent Route" is one of the most important and most direct steam railway lines from Cincinnati to points as far south as New Orleans.

The C., N. O. & T. P. Railway is at present in the hands of Mr. S. M. Felton, as receiver. Mr. Felton is one of the best known steam railway men in the United States, and, with the assistance of the force of active young men he has gathered about him, is succeeding in building up the immense property in his charge to a point where it in many respects surpasses, and in nearly every particular equals, many of our older and more prominent railroads in the East.

It is proper to state at this point that, as far as the Cincinnati Southern Railway is concerned, the officials in direct charge of this part of the system are thorough believers in the many advantages of electricity, and have put into operation on the road a number of applications of electric current which are working with perfect success, and which will be described in the following brief article. It is also worthy of note that this road, topographically, geographically, and from a traffic standpoint, is well adapted to use electric motive power. It may not be many years before at least a part of the road is equipped with electric locomotives. At any rate, the operating department is

watching carefully the experiments of other steam roads in this direction.

The electric lighting equipment of the Cincinnati Southern Railway is, at present, comprised in two plants, one of which is used to light the extensive shops and yards at Ludlow, Ky., while the other is used for a similar purpose at Somerset, Ky. The locomotives of the fast passenger trains are equipped with electric headlights, which have been found to be extremely practical and advantageous in service, and which are well liked by the engine men. The general outside appearance of the electric headlights, as shown in Fig. 2, is very similar to the ordinary standard oil-light. Current is furnished by a combined engine and dynamo set of four horse-power capacity, located behind either the headlight or the steam dome, or else under the running board of the locomotive. The arc light is of 2,000 candle-power. The electric headlight is controlled from the cab of the locomotive; all that is necessary to start the light burning is to turn the steam valve so as to start the engine. The road has recently been making some experiments with a new electric headlight made by Carlisle & Finch, of Cincinnati, which is unusually compact and light in weight.

Of course, the road maintains its own telegraph system, and is a liberal patron as well of the local telephone exchanges along its line. In spite of the fact that the Cincinnati Southern Railway is in a receiver's hands, and is thereby somewhat handicapped as to its expenditures, a wonderful number of improvements have been made during the last year. The roadbed has been brought up to a standard which compares most favorably with the principal railways of the East, bridges have been rebuilt and thoroughly repaired, the rolling stock has been brought up to date, and the discipline of the employés has been raised to a high standard.

One very important factor in increasing the efficiency of the operating force of the road has been the liberal use of the instruction car owned by the company. This car contains models and apparatus for complete instruction on air-brakes, automatic electric signals, electric headlights, the various forms of oil and gas lights used for car illumination, etc. The car is well arranged for its purpose, carries its own steam plant, and is set upon one four-wheel truck and one six-wheel truck, the two types used on the road. In the illustration on the preceding page, Fig. 1, is shown an interior view of a portion of this instruction car, giving a good idea of the automatic electric signal model employed for the instruction of train men. The model is a beautiful piece of work and is complete in every detail, the section of track used being an exact reproduction of a portion of the track on the road. Competent instructors are attached to the car at all times, and every train man must pass an examination of at least 80 per cent in electric signal practice. Train men are required to have certificates showing that they have passed such an examination.

The most important use of electric current on this road is, of course, the automatic electric signaling system. The Cincinnati Southern Railway is a single-track road, divided into two divisions, 335 miles of track in all. The first division extends from Cincinnati to Somerset, Ky., 160 miles, and the second division extends from Somerset, Ky., to Chattanooga, Tenn., 175 miles. Recently, at the invitation of Mr. W. J. Murphy, superintendent of the Cincinnati division, the writer was taken over the road in Mr. Felton's car for the purpose of examining the electric signal system. The party included a number of railroad men, among whom were Mr. H. M. Waite, Superintendent of Bridges and Buildings, and Mr. W. A. D. Short, Supervisor of Signals.

There are four distinct types of

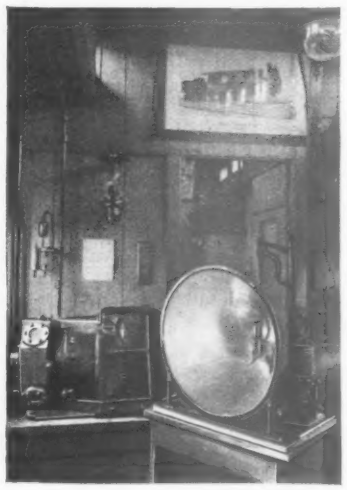


FIG. 2.—ELECTRICITY ON THE CINCINNATI SOUTHERN RAILWAY.—ELECTRIC HEADLIGHT AND GENERATING SET.

signals used on the Cincinnati Southern Railway: 1. Telegraph train order signals at all telegraph stations. 2. Distant switch signals at all switches that can not be seen at a distance of one-fourth of a mile, on account of curves. 3. Mechanical interlocking signals at all railroad crossings and terminals. 4. Automatic electric signals to control the safe passage of trains over curves, bridges and fills, through tunnels and cuts, and at stations. All these signals are mechanical in their operation except the last-mentioned class. There are 58 automatic electric signals, or 29 blocks, in the first division of 160 miles between Cincinnati and Somerset.

Railroad men use the term "block" to describe a length of track of defined limits, the use of which by trains is controlled by fixed signals prescribed and established for that purpose. Other terms relating to the automatic electric signal system are as follows:

Block signal—Fixed signals prescribed and established for the purpose of controlling the use of a block.

Home block signal—A fixed signal at the entrance of a block to control trains in entering and using said block.

Distant block signal—A fixed signal of distinctive character, used in connection with a home block signal and placed at a sufficient distance therefrom to regulate the approach thereto.

Advance (or starting) block signal—An auxiliary signal placed in advance of a home block signal and worked in connection therewith.

Block signal system—A series of blocks controlled by block signals.

An automatic block signal system is one which is self-operative, whether by mechanical, electric or other device.

On the Cincinnati division the shortest electric block is one mile long, and the longest is two and three-quarter miles. There are 27 tunnels on the road, the longest (one mile) and the shortest (200 yards) of which are in the first division. The approach to the longest tunnel is controlled by four blocks and eight signals, covering a distance of seven miles.

There are two kinds of automatic electric signals in use on the Cincinnati Southern Railway—10 of the well known Hall type and 48 made by the Union Switch and Signal Company, of Pittsburgh. In railroad parlance there are several kinds of blocks, chief of which are the isolated and the continuous block. In a general way the functions of the isolated block are performed as follows: There are two distinct electric circuits, a track circuit and a line circuit. There is no electrical connection between these two, but the track circuit controls the line circuit. The track circuit is formed by connecting the rail lengths together by iron wire bonds, each rail forming a side of the circuit. On the Cincinnati Southern Railway the standard has been adopted of making the same rail the same side of the circuit all the way through the blocks; that is, going south, the right-hand rail is the positive side of the circuit. The line circuit is formed of two No. 12 bare copper wires carried on the lower cross-arms of the telegraph line, which follows the track in the usual manner. The line circuit is utilized for carrying the battery current, which is used to hold the signals "clear". The track circuit is used for charging the magnet coils of the relays, through the contact points of which one side of the line circuit passes.

In order to secure the best working battery current, each isolated block is divided into track sections, the longest of which is one-half mile. At the beginning of each track section a battery well is located. In each of these wells two batteries connected in multiple arc are placed. The line batteries are placed at one end of the block, in the well, connected in series. The number of batteries necessary to supply the working current depends, of course, on the length of the block, the smallest number in use being three, and the largest number, 15. Ordinary blue-stone batteries are used.

In all blocks there is a preliminary section of track extending about 2,000 feet outside of the block proper. On the approach of a train the function of this preliminary section is to set the signal at the far end of the block at red or "danger" before setting the near signal. This is to prevent two trains, going in opposite directions, from entering the same block at the same time. If the signal is white before the train enters the block, and changes to red after the train enters the block, but before it reaches the signal, it indicates safety. If the signal is red before the train enters the block, or is white and doesn't change to red before the train reaches the signal, it indicates danger, and the train must stop. In the latter case, recourse is had to what is technically known as "flagging through the block".

In brief, the electrical action involved in operating an automatic signal is as follows: On the approach of a train the wheels and axle of the forward locomotive truck form a short circuit across the track circuit and break the line circuit by demagnetizing the relays. This causes the red disk in the signal (which is held up out of sight as long as there is current in the relays) to drop into position by its own weight, and thus give warning to the following or approaching train that the block is already occupied by a train. When a train leaves the block, the reverse operation occurs and the signal becomes clear.

Highway-crossing bells are used to warn people and vehicles against the approach of a train. They are controlled by electric current and work in the reverse manner from the block signals; that is, the train completes the circuit. When the engine gets opposite the bell it short-circuits the battery and the bell stops ringing. The battery wells are located below the frost line and the batteries are placed in little elevators, which are raised and lowered by blocks and falls.

One of the most interesting devices in use on the Cincinnati Southern Railway is the automatic electric lock used on the interlocking switches in the tower at Nicholasville, Ky. At this point, the Cincinnati Southern and the R., N., I. & B. roads cross each other. Railroad men have said that it is very doubtful whether there is another railroad crossing in the United States which combines all the disadvantages of this one. Both roads curve just before reaching the crossing, and just beyond the crossing the Cincinnati Southern runs through a deep cut, which prevents the man in the signal tower from seeing the approaching train. Superintendent Murphy conceived the idea of using an automatic electric-locking device in the tower, so that it would be impossible for the operator to give a clear signal to the R., N., I. & B. train, should the Southern train be out of sight in the cut. The Union Switch and Signal Company built the device which has been for some time in successful operation. The lock consists of a heavy relay, which, when magnetized by the presence of a train in the block controlled by the tower, makes it absolutely impossible for the tower men to throw the switch lever. Furthermore, when the lock is set, the crossing for perhaps 200 feet on either side is additionally protected by derailing switches, so that if the engineman attempts to "run the signals", he will derail his train before the crossing is reached.

These are but a few of the many improvements which are resulting

from Receiver Felton's policy of building up the Cincinnati Southern Railway. One very important fact regarding the road is that, although the locomotives burn soft coal, no black smoke is ever seen issuing from the smoke-stacks. Recently Prof. Paul Anderson, of the Kentucky State College, was employed to conduct coal tests on the road, and to give the firemen practical instruction in firing. The result of this instruction is that a large saving in the amount of coal used has been made, the firemen are more attentive to their duties, and travelers are relieved from the discomforts of coal-smoke, soot and dust.

Receiver Felton and his efficient staff are to be congratulated on the thorough manner in which they have protected their road by means of the electric signals and otherwise, so that the danger of accidents to passenger trains is reduced to a minimum.

STEPHEN L. COLES.

Papers To Be Read at The National Electric Light Association Convention.

President Frederic Nicholls has issued the following list of papers to be read at the twentieth convention of the National Electric Light Association, to be held at Niagara Falls, N. Y., on June 8, 9 and 10 next.

Some of the manuscript is already in the hands of the secretary, and, depending upon the assurance of the authors that their manuscript will be forwarded at an early date, it is expected that printed copies of each of the papers will be furnished members a reasonable time before the date of the convention:

Bean, W. Worth, St. Joseph & Fort Benton Railway and Lighting Company. "Municipal Lighting."

Cahoon, J. B., Elmira Municipal Improvement Company. "Standardizing Prices for Incandescent Light and Power."

Edgar, C. L., Boston Edison Company. "Correct Method for Charging for Product."

Jewell, W. S., Toledo Traction Company. "Cost of Delivery of Current from Station to Customer."

Martin, T. C., Editor *Electrical Engineer*. "The Daylight Work of Central Stations."

Stilwell, L. B., Cataract Construction Company. "Electrical Development at Niagara."

Thomson, Prof. Elihu, Lynn, Mass. "Recent Progress in Arc Lighting."

White, J. G., White-Crosby Company. "The Niagara Power Transmission Line."

Wilson, Professor, professor of electrical engineering at McGill University, Montreal; Chas. A. Carus, member Institute Electrical Engineers, New York and London. "The Induction Factor, a New Basis of Dynamo Calculation and Classification."

Wright, Arthur, president Municipal Electrical Association, England. "The Profitable Extension of Central Stations."

Mr. H. H. Vreeland, president of the Metropolitan Street Railway Company, of New York city, states emphatically that the report of his resignation is absolutely false, and that he has no intention of resigning.

The "Bijou" Inclosed Arc Lamp.

In the accompanying illustrations are shown three examples of the new "Bijou" inclosed arc lamp, manufactured by the General Incandescent Arc Light Company, of New York city. Mr. S. Bergmann, the president of the company, is one of the pioneers in the electrical business and has devoted much of his time and ability to the development of this line of lamps, which contain many novel and meritorious features. The "Bijou" inclosed arc lamp is claimed to be the first successful long-life arc lamp put on the market, by which consumers can be furnished with a steady, brilliant light for a current consumption of from two and one-half amperes up. On account of its extreme shortness, it can be used for illumination where the lowness of the ceilings has hitherto prevented the use of arc lamps.

The "Bijou" also has the same simple operating mechanism as the standard Bergmann inclosed arc lamp. The only modifications made have been in the exterior appearance, and such as have permitted a considerable reduction in the weight, size and length of the lamp, and a corresponding improvement in its ornamental appearance. There is claimed to be an average saving in the items of carbons and trimming of about one-half the cost of the lamps themselves per year. The "Bijou" is made for 50 and 100 hours of burning with one trimming, and operates with a potential of about 80 volts across the arc. It is provided with a resistance mounted on the lamp, so that it can be connected in multiple on circuits of 100 and 120 volts, provision being made in the resistance for this range of variation in the pressure. It will be observed from the accompanying illustrations that two of the lamps shown are not provided with outer globes around the globe inclosing the arc.

EXAMPLES OF THE NEW BERGMANN "BIJOU" INCLOSED ARC LAMPS.

Mr. H. B. Thayer, manager of the Western Electric Company, New York, returned last week from an extended and successful business trip to Japan. While in Japan Mr. Thayer acquired the native language as well as a large order for telephone supplies. The government is to spend $7,500,000 in the extension of the telephone service throughout the empire.

The Shelby Electric Company's Lamp Filaments.

In the ELECTRICAL REVIEW for March 3, 1897, the following statement was made: "It is understood that the only lamp manufacturer who will not be affected by the Westinghouse patents is the latest comer in the field, the Shelby Electric Company, of Shelby, Ohio. All the filaments used by this company are, it is said, imported ready for use from Europe."

Since the publication of the above, several of the lamp manufacturers who have taken out licenses under the patents of the Westinghouse Electric and Manufacturing Company, have disputed the statement that the Shelby Electric Company imports its filaments. The ELECTRICAL REVIEW had what it considered ample authority for making the statement, and would again make a similar statement on the same authority. It seems, however, that our informant was mistaken.

In response to a telegraphic inquiry addressed to the Shelby Electric Company at Shelby, Ohio, a reply, dated March 6, has been received, from which the following extracts are taken:

The question of taking licenses to manufacture under the Westinghouse patents is one which we have not definitely decided. . . . We have secured copies of the entire number of patents, which they claim to own or control, and we know positively that we do not infringe on any of them. We think that we are the only company manufacturing lamps in the United States to-day who can make such a statement. With reference to the filament which we use, we would say that we are using a square filament, not a cellulose filament. Our filament is not imported from Germany. We are manufacturing it here in Shelby, but it is the same filament which our Professor Chaillet discovered in Germany, and one that is now most successfully being used by two of the most prominent lamp factories of Europe, by a special arrangement with our Professor Chaillet. The filament is much nearer pure carbon than anything on the market, it being so hard after being carbonized that it will scratch glass very readily. . . . We could ourselves secure patents on over a hundred different devices, which we use in our manufacture, but prefer to keep them secret. . . . We are not selling lamps on prices, but on quality. . . . We will protect any one from any suit from any cause which might be created by their use or sale of any of our product.

PERSONAL.

Dr. Leonard Waldo, of Bridgeport, Ct., was among the out-of-town visitors to New York city last week.

Mr. J. F. Marks, of the Summersville & Mattoon, Ill., Electric Light Company, was among the Chicago visitors last week.

Mr. W. J. Murphy, editor of the Minneapolis *Tribune*, and prominently identified with Grand Forks, Crookston and Seattle electric lighting properties, was among the Chicago visitors last week.

Mr. D. M. Downs, manager for Wm. Brookfield, the well known manufacturer of glass insulators, spent several days in Chicago last week. Mr. Downs reports the outlook for a good Spring trade as more than encouraging.

Mr. P. M. McLaren, who is well known to all electrical men through his former association with a prominent boiler company, has made an important connection with the Atlas Cement Company, of 143 Liberty street, New York city.

Mr. Marsden J. Perry, the well known electric light man, of Providence, R. I., who was recently appointed receiver of the United Telegram Company, has filed his bond to the amount of $20,000 in the United States Circuit Court. The Fidelity and Deposit Company, of Maryland, is surety.

Mr. Samuel Insull, president of the Chicago Edison Company, was present at Washington during the inauguration and attended, by invitation, the swearing-in ceremonies of the new Secretary of the Treasury, Hon. Lyman J. Gage, of Chicago. Mr. Insull will visit New York city before returning to the West.

Out of-town visitors registered at the headquarters of the National Electric Light Association, last week, as follows: F. S. Marr, Philadelphia, Pa.; T. H. Brady, New Britain, Ct.; T. Bibber, Boston, Mass.; F. P. Kennedy, Fulton, N. Y.; A. J. Smith, Cleveland, Ohio; J. H. Reid, Pittsburgh, Pa.; H. B. Cutter, Philadelphia, Pa.; E. L. Babcock, Cuyahoga Falls, Ohio.

The many friends of Mr. W. B. Somerville, superintendent of the Press Bureau, Western Union Telegraph Company, who has been dangerously ill for three weeks, will be glad to learn that he has been pronounced by his physicians to be out of danger, and on the road to complete recovery. It is expected he will be able to resume his duties within a week.

Mr. George Bullock, president of the Bullock Electric Manufacturing Company, Cincinnati, is in New York city on business connected with the Bullock Electric Company, general eastern agents for the first-named company. The New York offices of the Bullock Electric Company comprise one of the handsomest suites in the new St. Paul Building, Broadway and Ann street.

The ELECTRICAL REVIEW is informed that an attachment for $504 has been issued against the Electric Selector and Signal Company, 45 Broadway, New York city.

DISCUSSION ON "ELECTRICITY FROM CARBON WITHOUT HEAT".*

(*Concluded from page 103.*)

Mr. Mailloux: Do you ever find any compounds, such as melligin, as the result of the action of the chlorine on the carbon, this peculiar combination of carbon, chlorine, hydrogen and oxygen?

Mr. Case: The analysis shows there was CO^2 present, chlorine and some free oxygen. The battery was sent by me to a chemist for careful analysis, and that was the report. The chemist also looked for platinum, but did not report finding any. The analyses were made six or eight years ago, and I do not remember the details, except that CO^2 was the principal product.

Mr. Mailloux: It is quite usual to find melligin as one of the results of chemical reaction where chlorine and carbon is combined. The carbon disintegrates and gives rise to a peculiar brownish buttery or almost viscous substance, to which that name has been given. I have a faint suspicion that it contains 10 or 12 molecules of carbon, 11 or 12 of hydrogen, chlorine, etc. It gives rise to a great deal of trouble in connection with all electrolytic processes where the anode is made with carbon compounds. Whether it is due to the constitution of the carbon, or other cause, I do not know. I should imagine it would tend to clog the cell, increase its internal resistance, or introduce other complications.

Mr. Case: I find that different forms of carbon produce different electro-motive forces. They all seem to be acted upon differently. Graphite is acted upon and we have graphitic acid; carbon from sugar gave a caramel-like substance and low electro-motive force; animal charcoal gave another condition, etc.

Mr. Bradley: Is that a thermo-pile you have on the end of the table?

Mr. Case: Yes, sir.

Mr. Bradley: What one is it?

Mr. Case: It was one loaned to me by a friend simply to illustrate the fact that heat could be converted into work.

Mr. Bradley: It seems to me a good one, and I would like to know what make it is.

Mr. Case: It was described in the *Electrical Engineer*, August 9, 1896.

President Emery: Do you recollect what the electro-motive force was for graphite?

Mr Case: I have it here. Graphite opposed to platinum gave an electro-motive force of 0.7 volt. Different forms of amorphous carbon were substituted in place of graphite. Gas carbon gave an electro-motive force of 0.007 volt when opposed to platinum in sulphuric acid. On the addition of chlorate of potassium the electro-motive force equalled 0.5 volt. Carbon produced by the action of sulphuric acid or cane sugar gave 0.3 volt. The carbon of animal charcoal, wood charcoal, coke and anthracite coal gave an electro-motive force variable with each form, ranging from 0.3 volt to 1.25 volt.

President Emery: We have in Rhode Island a coal field nearly graphite; it has gone beyond the period of hard coal to such an extent that it is hard to use it, and I was wondering whether it was going to be a future source of electricity.

Mr. Sherr: As I understand, there is only caustic in that nickel crucible.

Mr. Case: Yes, sir.

Mr. Sherr: In these other forms of batteries you bubble oxygen through the electrode.

Mr. Case: You would have to do the same in that if it was larger; it is so shallow and exposed to the air that the oxygen is absorbed.

Mr. Sherr: It would be more efficient with it?

Mr. Case: The electric current runs up rapidly when you force the air through the battery. I am sorry I did not have a larger cell, replacing the iron with nickel, and we would have had more satisfactory results.

Mr. Rome: I saw in one of the electrical papers that Prof. Elihu Thomson says the action of the Jacques cell is never from the heat, and I think Professor Reed says it is almost entirely from the heat.

President Emery: I had in my mind some doubt as to the action of the cell; but when we have presented before us means for transferring oxygen, I saw at once we were in a broader field, and that the subject was better understood than in any discussion of it I had heretofore seen.

Mr. Case: I think it is an open question yet as to whether it is galvanic entirely or thermo-electric; some incline to the idea that it is both. I think Mr. Reed does. Professor Thomson thinks it is a reducing action, in which the oxide of iron is reduced and absorbs more oxygen, which is again reduced by the carbon. I think it is an open question as to how much, to what extent, the action is due to thermo-electricity. The presence of the electrolyte, however, as I show you to-night, is necessary. You can take the carbon without the caustic soda on it and put it on the outside of the vessel and it will give no current. If you put more oxygen in and blow air through it, the electro-motive force runs up and the current runs up. Some say that is due to the chilling effect of the air. Possibly it is; I do not know. We know the carbon is oxidized and burned up and we get the current.

Mr. Tokio: Have you experimented with other forms of carbon, in solution, as it is found in the blood?

Mr. Case: I have tried various forms of oils and hydrocarbons, and tried to make them good conductors.

Mr. Mailloux: Have you ever gotten results from hemoglobin as an electrolyte?

Mr. Case: Yes; if we put a piece of platinum in here [indicating], you will get an electro-motive force from it. (Applause.)

Mr. Mailloux: How does that compare with the electro-motive force obtained between the center of nervous fiber and the periphery?

Mr. Case: It is from half a volt up to one volt.

Mr. Mailloux: It seems to me that might suggest some idea as to the processes of obtaining electrical energy commercially by following the methods of developing energy as it occurs in the human body. There is probably something in the tissues that acts in a manner similar to that of dialisis, and if the voltage obtained by your battery is at all similar, we might fairly assume that there was a similarity of conditions.

Mr. Case: This could be done if we could get the right kind of carbons. Experiments with this electric light carbon is different from experiments with animal tissues. There are three schools; one believes that the body is a heat engine, the other that it is an electrical motor, and I do not know just what the third one is.

A voice: A gas engine.

Mr. Case: The best paper on that subject was read before the Royal Society, March 4, 1895, by Professor Engelmann in his Croonian lecture.

* Paper by Willard E. Case before New York Electrical Society, February 24, 1897.

Siemens's Hand-Pressure Electric Drill.

When Messrs. Yarrow & Company were building the Argentine torpedo boat destroyers *Santa Fé, Entre Rios* and others, they made use of Messrs. Siemens Brothers' interesting hand drill, says the London *Electrical Review*. The great feature about this drill is that it can be readily carried about by a workman, and may be used in any other position than that shown in the illustration, by means of suitable slings. The drill spindle is driven through reducing gear by an electric motor, the current to which is supplied through a flexible cable, so that the drill may be at a considerable distance from the source of power. The whole drill is self-contained, and is fitted with a cut-out and switch. To avoid any injurious shock on the termination of drilling, the end of the drill is fitted with an india-rubber cushion.

The drill illustrated will bore holes up to three-eighths of an inch in

SIEMENS'S HAND-PRESSURE ELECTRIC DRILL.

diameter, and weighs 46 pounds; the drill spindle runs at about 300 revolutions per minute; the motor takes a current of two amperes at a pressure of 110 volts—equal to one-third of a horse-power.

From experience it has been found that whilst eight holes per hour can be drilled by hand, 35 holes can be drilled in the same time with the electrically-driven drill.

Complete Data on Transformer Tests.

We have received from the General Electric Company a pamphlet entitled "A Complete Test of Modern American Transformers of Moderate Capacities," by Arthur Hillyer Ford, B. S., Fellow in Electrical Engineering, University of Wisconsin. This is reprinted from the bulletin of the University, and is a very interesting and complete account of data on the subject named.

True, True.

[*From the Cleveland Leader.*]

Lives of great men all remind us
We can make our lives sublime,
And to do it we have simply
Got to hustle all the time.

A New Method of Driving An Induction Coil.

[*From Science.*]

Since the induction coil has come into prominence through the discovery of the X rays of Roentgen, considerable attention has been turned toward devising some means which is applicable to long runs, on a voltage such as is furnished by electric light mains, 110 or 220 volts. The more recent forms of break work well with storage batteries, but these are troublesome, and a break which will work satisfactorily on the voltage of ordinary electric light mains is yet to be supplied. The following method has been devised to meet these difficulties:

A condenser of considerable capacity is first connected to the lighting mains and charged at 220 volts. It is then disconnected and discharged through the primary coil. The charging and discharging of the condensers is effected by means of a commutator. In this way the only current passing through the coil is from the condenser. The commutator is on the shaft of a small fan motor.

A six-inch Ritchie coil connected in this way with a condenser of 25 microfarads, its own condenser being disconnected, gives a thick, fuzzy spark about two inches long. Removing the primary of the coil and replacing it by about 70 turns of rather heavy wire, No. 8 or 6 Brown & Sharpe, we get a multitude of fine zig-zag sparks about six inches long, the discharge being identical in appearance with that from an induction worked in the ordinary manner under the best conditions. The introduction of iron, unless finely laminated, cuts down the discharge to about one-tenth its value. Increasing the speed of the charge and discharge of the condenser up to about 2,000 per minute, which is the limit of the very crude commutator at present employed, improves the discharge of the coil in quantity and voltage. The sparking on the commutator is very slight, and the amount of power taken from the mains is small.

The discharge obtained in this way, so far as we can now judge, seems well suited for driving X-ray tubes. Tubes so driven give a brilliant fluorescent screen with strong, sharp shadows. An exposure of 20 seconds gives a good photograph of the hand.

CHAS. L. NORTON,
RALPH R. LAWRENCE.
Rogers Laboratory of Physics, Massachusetts Institute of Technology, Boston, February 17.

The City Council of Pawtucket, R. I., has passed the resolution authorizing the Mayor to make a contract with the Pawtucket Electric Company to light the streets of the city with electricity for a term of five years. This contract provides for 50 divided arc lights, 1,200 candle-power, to burn all night long, for the sum of $112.50 per light per year, and for 200 divided arc lights, 1,200 candle-power, to burn until one o'clock, or as long as the best carbons will last, for $72.50 per light per year, moonlight schedule, to burn not less than 300 nights per year.

Hawker's Electric Current Regulator.

To regulate the intensity of an electric current, more particularly as used with incandescent electric lamps, the improvement represented in the accompanying illustration has been patented by William Hawker, of Windsor Mills, Quebec, Canada, says the *Scientific American*. The regulator is designed to be of especial value in a sick room or hospital, or in other places where it is desired to turn down the light, as may be done with a gas jet, without entirely extinguishing it, and it may also be used with many devices, the principle being designed by the inventor for application with either alternating or direct currents. On a suitable base plate is a pair of resistance coils and four pairs of contact plates, as shown in Fig. 1, and shunts extend from the first pair of contact plates to connections with the lower ends of the coils. From the second pair of contact plates the shunts are tapped into the coils at a point perhaps a quarter or a third of the distance up, and from the third pair of contact plates the shunts are connected with the coils at a still higher point, while the last pair are connected with the lead wires, from one of which a shunt leads into the upper end of one resistance coil, and from the other a shunt leads to the upper end of the other coil. On the base are two main contact plates with which the lamp wires are connected; and to close the circuit between them and the plates connecting with the resistance coils, a block of insulating material is employed, as shown in Fig. 2, the block being moved by a screw shaft having at its outer end a crank handle, and the block having at its ends metal plates electrically connected by a strip of metal. As will be readily understood, a varying resistance, increasing or diminishing the intensity of the light, is obtained by connecting the several plates to the resistance coils at different points. The improvement is here shown adapted for use in connection with one incandescent lamp, but the regulator may be made of any suitable size for use in connection with a series of lamps or other devices, although the inventor has patented another form of regulator designed to use with a number of lights.

Next Meeting of the National Electric Light Association.

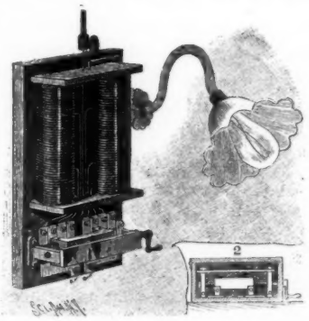
The date for the next convention, the twentieth, of the National Electric Light Association has been fixed by the executive committee as Tuesday, Wednesday and Thursday, June 8, 9 and 10, 1897.

The place of meeting, as already announced in the ELECTRICAL REVIEW, is Niagara Falls, N. Y.

The New York & New Jersey Telephone Company, whose executive offices are at 16 Smith street, Brooklyn, N. Y., have issued a very attractive calendar showing a map of their territory, and giving on the calendar slip for each month good advice as to why every one should use the telephone.

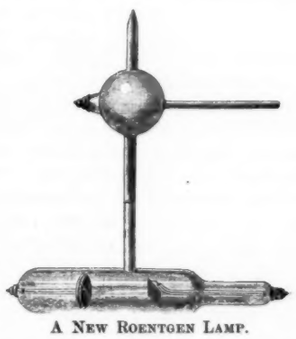
A New Roentgen Lamp.

Siemens & Halske have recently produced a new lamp for the production of Roentgen rays, in which the vacuum can be easily regulated to produce the maximum effect, says our London namesake. The air pressure is reduced by taking advantage of the circumstance that when air, rendered luminous by the passage of electricity, comes in contact with the vapors of phosphorous, iodine or similar substances, it forms solid bodies; the vacuum is reduced by warming the bulb in the well known way. From the illustration, it may be seen that a



HAWKER'S ELECTRIC CURRENT REGULATOR.

supplementary bulb is joined on to a cylindrical focus tube by a glass connecting tube. In the bulb is an additional anode, and opposite this anode is a small adjutage tube, whose walls are covered with the air-absorbing material; for example, phosphorous. If, when the lamp is excited and examined by a screen, the fluorescence is weak and the blue cone from the cathode shows that the vacuum is too low, the positive pole of the induction coil is connected to the auxiliary anode in the bulb, and the discharge continued till the vacuum is sufficiently reduced. The special improvement



A NEW ROENTGEN LAMP.

in this lamp is evidently intended to provide the means of reducing the air pressure when it is too high; but all experience with X-ray tubes seems to demand rather some convenient means of increasing the air pressure, which is soon enough reduced by the cathode discharge in the ordinary working of the tube. Heating the tube may stave off the difficulty for a time, but after long use this device is useless, and the tube has finally to be abandoned. The Siemens-Halske tube, however, appears to be very efficient while it works. With a six-inch coil it is stated that it will show the skeleton of the hand through a brass plate two millimetres thick.

ELECTRICAL REMINISCENCES—THE FIRST TELEGRAPH AND FIRST ATLANTIC CABLE.

BY WALTER P. PHILLIPS.

Those of you who are familiar with the important part played to-day in the making of newspapers by the telegraph, the cable and the telephone, have never thought, perhaps, of the difficulties surrounding the introduction of each and all of them. The story of Professor Morse and his futile attempts to obtain an appropriation from Congress with which to construct his experimental line between Washington and Baltimore has often been told, however, and can not be new to many, but I refer to it more to render it pertinent to say that the telegraph was made possible by a woman. The widow of the late Roswell Smith, editor of the *Century Magazine*, while she was Miss Ellsworth, the daughter of the Commissioner of Patents serving under President Tyler, was greatly interested in the invention of the young painter, who had turned his attention from recognized art to experimental science. She saw him returning from the Capitol day after day, disheartened and almost hopeless, and when she saw Morse on the verge of despair she imbued him with new courage by her sweet sympathy and by the repeated assurance that she had implicit faith in his complete triumph. When that triumph came, tardily enough, too, and after the appropriation of $30,000 had narrowly escaped being split up so that a third should be devoted to mesmeric experiments and another third to investigating what is known as Millerism — when that triumph came, Miss Ellsworth, by a most commendable but unusual display of thoughtfulness, was chosen as the person to send the first message over the wire. "What hath God wrought" were the words chosen by her to inaugurate the operation of what has now come to be to commercial and social life what the nerves are to a human being. And her words are still ringing in our ears.

Bishop Potter has said that nothing is so unpopular as an innovation. Let us see. When Morse's line was working as smoothly as the telegraph is working to-day, after a lapse of nearly 50 years, and a message was brought from Baltimore to Washington announcing that Silas Wright had been chosen to run on the Presidential ticket with James K. Polk, an answer was immediately returned, saying that Mr. Wright declined the honor. The Solons of that day and generation, in convention assembled, were not to be beguiled by any diaphanous stories purporting to come from Washington by a process so palpably open to suspicion as the telegraph, so they adjourned over while a committee went to Washington and sadly returned with the confirmation of Mr. Wright's expressed desire not to serve. That great telegraphic veteran, David Brooks, of Philadelphia, once told me that when he was the manager of the telegraph office in Harrisburg—and he said he could not remember the year, but added that it was along about the time the soldiers were coming home from the Mexican War—that when he was manager at Harrisburg he could not get business enough to pay his board. He added that people regarded the telegraph as a toy, and never thought of using it for any serious purpose, using the mails for their ordinary communications with Philadelphia, and "when they were in a great hurry to receive intelligence," said Mr. Brooks, "they went to Philadelphia in person. They usually walked, but in cases of extreme urgency they took a conveyance. It never occurred to them to use the telegraph."

When, after years of labor and a display of almost superhuman patience, the Atlantic cable was finished very few persons believed that messages passed over it. After a few days it ceased to work, and as no one knew the reason why, the public shrugged its shoulders and knowingly referred to Barnum in a familiar way and quoted his assertion that the American public liked to be humbugged. In that first cable very thin wires of low conductivity and correspondingly high resistance were used, and the life of the fragile conductor was destroyed, just as by a decree of the New York Legislature human life is ended in the fatal chair where Kemmler sat at Auburn, and in which many others doomed to die have quickly, and without a sign, passed from life to death. When we reflect that, according to the electricians, the needle of a galvanometer can be deflected on the Irish coast by such electricity as can be generated on this side of the ocean by the action upon it of what acidulated water can be held in a percussion cap, it is not difficult to understand that the first cable failed from a too heavy application of battery. It was simply burned to death. After that, a few years later, came the second cable, which was a success. But it was not much used, and years were required in which to teach the people, the newspapers and the commercial world the value of instantaneous connection with Europe. It was a great achievement to have established this system of communication under the seas, and the patient and persistent endeavor of Cyrus W. Field should never have been forgotten. But he is gone, and for many years prior to his demise no one thought of him as the man who brought the dwellers on both sides of the ocean to think of the same things at the same moment, and who, in doing so, gave civilization one of its greatest upward movements. He became a speculator and was plucked by Samuel J. Tilden, and afterward, in a game of financial fisticuffs over the affairs of the Manhattan Elevated Railroad, his antagonist, Mr. Gould, was an easy winner. Mr. Field died comparatively poor; but however dimly his light had burned for a few years preceding his death, he was a wonderful man, full of determination, stopping at nothing, and sanguine that his scheme of oceanic communication was practicable. I had heard of the many trips he had made to Europe on cable business, and meeting him in Washington a dozen years ago, I said:

"You have crossed the Atlantic 60 times, I hear."

"Yes," he replied. "I have made 64 trips and was seasick on every one of them."

Electrical Review

Times Building, 41 Park Row,

P. O. Box 2339. NEW YORK.

EDITOR:
CHARLES W. PRICE.

ASSOCIATE EDITOR:
STEPHEN L. COLES.

REGISTERED CABLE ADDRESS:
"ELECTVIEW," NEW YORK.

1546 "CORTLANDT," TELEPHONE CALL.

WESTERN OFFICE:
CARL E. KAMMEYER, Representative,
1627 MONADNOCK BLOCK, CHICAGO.

LONDON OFFICE:
HENRY W. HALL, Representative,
42 OLD BROAD STREET, LONDON, E. C.

News, Subscriptions and Advertisements.

Subscription to the
ELECTRICAL REVIEW.

One Year, United States and Canada, - $3.00
One Year, Foreign Countries, - - 5.00
Single Copy, - - - - - - - .10

Copies can only be supplied for one year back at 25 cents each.

Special Notice to Advertisers.

CHANGES for advertisements must be in this office by Friday noon for the following week's issue.

NEW ADVERTISEMENTS should be in the office not later than Saturday noon to insure publication the following week.

NEW YORK, MARCH 10, 1897.

CONTENTS.

	PAGE
Views, News and Interviews	109
Laconia Car Company	109
Electricity on the Cincinnati Southern Railway	109
Papers To Be Read at The National Electric Light Association Convention	111
The "Bijou" Inclosed Arc Lamp	111
The Shelby Electric Company's Lamp Filaments	111
Personal	111
Discussion on "Electricity from Carbon Without Heat"	112
Siemens's Hand-Pressure Electric Drill	112
Complete Data on Transformer Tests	112
True, True	112
A New Method of Driving an Induction Coil	112
Hawker's Electric Current Regulator	113
Next Meeting of The National Electric Light Association	113
A New Roentgen Lamp	113
Electrical Reminiscences—The First Telegraph and First Atlantic Cable	113
The New Administration	114
Static Machine for X-Ray Work	115
Three Accidents	115
The ELECTRICAL REVIEW's New Representatives	115
Binghamton General Electric Company Sold	115
Dicision on an Electric Heater Switch	115
Telephone News and Comment	116
What an Ad. Is For	116
Deaf Mutes and the Morse Telegraph Alphabet	116
Mr. Carl E. Kammeyer	116
Central Electric Station of the Davis Coke and Coal Company	116
Armory Lighting in New York City	117
Conductivity of Incandescent Carbon Filaments and of the Spaces Surrounding Them	118
Wants To Complete the Road	119
The Edison Direct-Current Cautery Transformer for 110-120-Volt Circuit	119
An Automatic Return Telephone Switch	119
Electric Railway Notes	119
Advance Information	120
Electric Railway Work in Chicago	120
Kindred Interests	ix
Electrical Patents	x
Incandescent Lamp Shade-Holder	x
Standardizing Lamp Sockets and Bases	x
Items of Interest	x

INDEX OF ADVERTISERS.

COVER PAGES.

	PAGE
Abendroth & Root Mfg. Co., boilers	xvi
American Electrical Works, insulated wire	i
American Engine Co	i
Babcock & Wilcox Co	xvi
Buckeye Electric Co	xvi
Bunnell & Co., J. H., dry batteries	i
Campbell & Zell Co	i
Crefeld Electrical Works	i
Crocker-Wheeler Electric Co	i
Day's Kerite, insulated wire	i, viii
Electric Appliance Co., supplies	i
Fort Wayne Electric Corporation	xvi
Gresley, The E. S., & Co., electrical supplies	i
Hoopes & Townsend	xvi
Interior Conduit and Insulation Co., Lundell dynamos and motors	i
Iron Clad Rheostat Co	i
Lombard Water-Wheel Governor Co	xvi
New York & Ohio Co	i
New York Insulated Wire Co., Grimshaw wires and cables	i
Okonite Co., insulated wire	i, xvi
Partridge Carbon Co., motor and generator brushes	i
Safety Insulated Wire and Cable Co	i
Standard Paint Co., insulating compound	i
Stanley Electric Mfg. Co., S. K. C	xv
Stirling Co., water-tube boilers	xvi
Thayer & Co	i
Western Electric Co	ii
Westinghouse Electric & Mfg. Co	xv

INSIDE PAGES.

Adams-Bagnall Electric Co	v
American Bell Telephone Co	xiii
American Electric Telephone Co., long-distance telephones	xiii
American Engine Co., American-Ball engines	vii
Automatic Switch Co	iii
Aylsworth & Jackson	xi
Baker & Co., platinum	vi
"Big Four" R. R	xii
Bliss Co., E. W., presses, dies, shears, etc	iv
Brady, T. H., Brady mast-arms	xi
Brill, J. G., Co	xiv
Brixey, W. R., Day's kerite wires and cables	viii
Brush Electric Co	xiii
Bullock Electric Mfg. Co	xiv
Carbutt, John, X-ray plates and films	xi
Central Electric Co., electrical supplies	iii
C. & C. Electric Co	vi
Clonbrock Steam Boiler Co	iii
Coles, Walter S	x
Corborumdum Co	vii
Correspondence School of Technology	xi
De Veau & Co	v, xii
Diehl Mfg. Co	iii
Dixon, Jos., Crucible Co., belt dressing	xi
Duval, E. S., Jr., patents	x
Dyer & Driscoll, patent solicitors	x
Eastman Kodak Co	x
Edison Mfg. Co	xi
Edwards & Co	xi
Electric Launch Co	ix
Elwell-Parker Electric Co. of America	v
Empire China Works, porcelain specialties	iv
Eppenger & Russell Co., Valentine subway electrical conduit	vi
Eyanson & Armpriester	vi
Faraday Carbon Co., carbons	viii
Forest City Electric Co	iv
Globe Electric Heating Co	vi
Green & Bauer	xi
Hampson, E. P., & Co., engines	iv
Hemingray Glass Co	ix
Hooven, Owens & Rentschler Co., electric railway and electric light engines	iii
Huebel & Manger	ix
Hunter Fan and Motor Co	v
Imperial Porcelain Works	iv
India Rubber and Gutta Percha Insulating Co	iv
International Correspondence Schools	ix
Jewell Belting Co	iv
Keystone Electrical Instrument Co	viii
Leffel & Co., Jas	iv
Lehigh Valley Creosoting Co., creosoted lumber	ix
Marshall, Wm., condensers	ix
Mason-Maxwell Telephone Mfg. Co	xii
McIntire, C., Co., The, connectors and terminals	x
McLeod, Ward & Co	xi
Metropolitan Electric Co	xiv
Mexico Telephone Co	xii
Miamus Electric Co	xii
Mosse, Rudolf	x
Murdock & Taber	xiii
New England Engineering Co	vi
New York Telephone Co	xii
Novelty Electric Co., supplies	vi
Ostrander, W. R., & Co., supplies	x
Partrick & Carter Co., electrical supplies for housework	ix
Pettingell-Andrews Co	vii
Phillips Insulated Wire Co., wire	viii
Reisinger, Hugo	viii
Ridlon Co., Frank	vii
Ritchie & Sons, E. S	xi
Royce & Marean, electrical supplies	ix
Sawyer-Man Electric Co	v
Schiff, Jordon & Co., carbons	viii
S. E. I. Co	viii
Sessions Foundry Co	iv
Siemens & Halske Electric Co. of America	vii
Solar Carbon and Manufacturing Co	vi
Spring Park Laboratory	xi
Standard Thermometer & Electric Co	vi
Sterling Supply & Mfg. Co	xiv
Thompson, E. P	x
Utica Electrical Mfg. & Supply Co	ix
Viaduct Mfg. Co., telephones, etc	xii
Wedderburn & Co., John, patents	x
Western Electric Co	xiii
Western Telephone Construction Co	xiii
Weston Electrical Instrument Co., measuring instruments	viii
White-Crosby Co., contracting engineers	ix
Whitney Electrical Instrument Co	ix

A newspaper man of Santa Rosa, Cal., is reported to have discovered a substitute for india rubber. The claim is that a vegetable substance containing all the necessary properties of caoutchouc has been found. It is soft and elastic at ordinary temperature, and very firm and inexpansive below zero. The manufacturers of insulating products will all be interested.

THE NEW ADMINISTRATION.

President McKinley and Vice-President Hobart have been inaugurated, and the new administration assumes office with extraordinary responsibilities. After four years of almost unparalleled business depression, after one of the bitterest and hardest-fought campaigns in our history, at a time when many of the industries of the country are sadly crippled, Major McKinley assumes the Presidency with cheerfulness, calmness and an abiding faith in the people, which augur well for us all. It is incumbent upon every citizen, no matter what his political belief, to put his shoulder to the wheel and to assist by every means within his power in the task of re-establishing prosperity.

No administration, of any party, can accomplish anything without the assistance of the people by whom and for whom the integrity of our institutions is maintained. We urge upon every one connected with the electrical and allied industries to do his best toward the restoration of business confidence and prosperity. Encouragement, if any be needed, may be had from Major McKinley's splendid inaugural address, from which we make the following quotations:

The responsibilities of the high trust to which I have been called—always of grave importance—are augmented by the prevailing business conditions, entailing idleness upon willing labor and loss to useful enterprises. The country is suffering from industrial disturbances, from which speedy relief must be had. Our financial system needs some revision; our money is all good now, but its value must not further be threatened. It should all be put upon an enduring basis, not subject to easy attack, nor its stability to doubt or dispute. Our currency should continue under the supervision of the government.

With adequate revenue secured, but not until then, we can enter upon such changes in our fiscal laws as will, while insuring safety and volume to our money, no longer impose upon the government the necessity of maintaining so large a gold reserve, with its attendant and inevitable temptations to speculation.

Business conditions are not the most promising. It will take time to restore the prosperity of former years. If we can not promptly attain it, we can resolutely turn our faces in that direction and aid its return by friendly legislation. However troublesome the situation may appear, Congress will not, I am sure, be found lacking in disposition or ability to relieve it, as far as legislation can do so. The restoration of confidence and the revival of business, which men of all parties so much desire, depend more largely upon the prompt, energetic and intelligent action of Congress than upon any other single agency affecting the situation.

It is inspiring, too, to remember that no great emergency in the 108 years of our eventful national life has ever arisen that has not been met with wisdom and courage by the American people, with fidelity to their best interests and highest destiny, and to the honor of the American name. Those years of glorious history have exalted mankind and advanced the cause of freedom throughout the world, and immeasurably strengthened the precious free institutions which we enjoy. The people love and will sustain these institutions.

It is stated that New York city is threatened with a general sympathetic strike on all the large office buildings now in course of construction. The trouble seems to be due to a dispute between the International Association of Machinists and the Elevator Constructors' Union as to which of these two labor organizations is to perform certain work. The work includes dynamos and motors where electric elevators are used, and the engines, pumps and hoisting apparatus for all elevators. The delegate of the Machinists' Union has notified two of the principal electric elevator companies that they must employ the men who, in his opinion, are entitled to the work, or else a strike will be ordered in the shops of the companies, to be followed by a general strike on the buildings in process of construction. It is very apparent that the walking delegate has little to do these days when such a trivial excuse for a general strike is even considered.

A Louisville, Ky., police court judge has held that where there is no conductor on a street car, passengers are required to drop their fares in the box upon entering the car. Three young men who refused to deposit their fares in a box and demanded that a conductor collect them, were fined $5 each by the judge. If this idea were carried to the extreme, it would mean a great saving to the various street railway companies, as they could then dispense with one employé on every car in use. We believe that the principle of this ruling is not in equity or good law.

The article relating to a new method of casting copper, published in the ELECTRICAL REVIEW last week, has attracted much attention. The announcement was widely copied, and many manufacturers have written to the REVIEW for additional information. If the claims for the new process are fully substantiated, it will, undoubtedly, have a decided effect on the copper market as well as electrical manufacturing.

Static Machine For X-Ray Work.

To the Editor of Electrical Review:

New achievements in the practical application of the X ray have not ceased to be of interest. The marvelous results obtained must needs be astonishing to many, but to one, who, during the past year has devoted much energy to this work, these results appear to be natural, and only what might be expected. That many of the difficulties, so long impeding the work, have not sooner been overcome seems now the more surprising. The intellectual inertia of the human mind is no where better illustrated than in the history of the development of X-ray generation.

Could Roentgen have obscured the kind of exciting apparatus used and the form of vacuum tube employed, and thus have forced investigators to launch out on methods of their own devising, we should much sooner have arrived at the practical results which we are now obtaining.

That Roentgen should, from necessity, have used an induction coil in his work, has led many to believe that the "philosophers stone" was to be found in the path there indicated. Fortunately, however, a few investigators have been willing to consider the essential conditions and to strive to produce them unimpeded by the actual environment of others.

The conditions which long experience has led me to believe must be produced in the exciting apparatus are in the order named: Rapidity of discharge, high potential and low current.

Without discussing, at this writing, the manner in which these conditions are met in other forms of exciting apparatus, I wish especially to speak of the latest development of the *influence* or *static* machine. The problem, heretofore, has been to produce a machine which would discharge with sufficient rapidity to give deep penetration. Many experimenters have been using influence machines, which would give good definition, and in general very satisfactory results on the hand or other thin portions of the body, and were absolutely inadequate for general practical work.

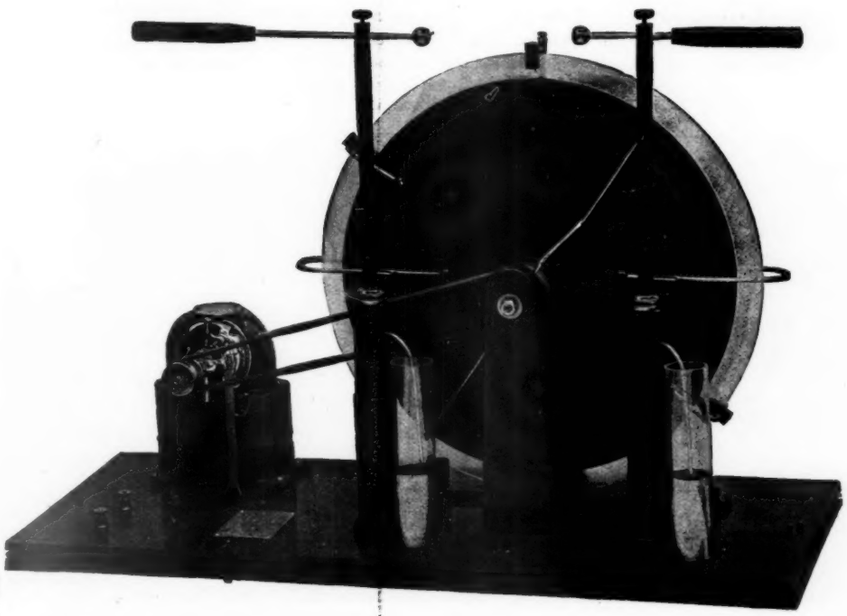
The limitations surrounding the glass-plate machine are apparent—high speed, of course, is out of the question. Sufficient accumulation for frequent discharge of the condensers can, then, only be obtained by increasing, to a certain extent, either the diameter or the number of plates. This fact has led to the use of hard-rubber plates, which are only so large as is necessary to produce the required *length* of discharge, and then to increase the accumulation and consequently the rapidity of discharge by speeding to a very high point. When this machine is operated by hand power the speed is obtained by a combined gear and belt. In most of the work, however, the power is obtained by motor. The design of the machine, which is made by the L. E. Knott Apparatus Company, of Boston, is such that either a direct or alternating current motor may be placed on the inside of the case, when the whole is shielded from dust and moisture. This I deem one of the most important points in the construction of a static machine.

Having noted in various journals that the reversal of polarity is an unfortunate attribute of the static machine, I wish to state that this seems to have been entirely overcome in the machine which I am using.

In short, my machine has never failed to work and has speedily proven itself to be one of the best, if not the best, X-ray generator which has yet been devised.

E. E. Peirce.

Boston, March 5.



New Static Machine for X-Ray Work, made by the L. E. Knott Apparatus Company.

The three-cent street car fare bill was killed in the Indiana House on March 3.

Three Accidents.

On Thursday last an accumulation of illuminating gas in the new subway in Boston exploded, killing eight persons in all, injuring about 50 others and destroying several trolley cars. The gas is supposed to have escaped from the mains in the street, which were disturbed in the work of building the subway. The gas was probably ignited by a spark from a passing car.

Owing to the breaking down of a large piece of shafting at the plant of the Edison Electric Illuminating Company in Paterson, N. J., on March 2, the streets were in darkness for some hours. Only the arc system was affected by the accident.

The power house at Thirteenth and Mount Vernon streets, Philadelphia, from which the Union Traction Company operated a half-dozen of its lines of trolley cars, was destroyed by fire on March 3. The loss is about $500,000, principally on the machinery in the building. The power house was a large brick structure, covering a third of the block, and contained eight dynamos and other machinery. About six o'clock some of the employés were swinging a big crane around and the iron chain hanging from the arm struck a generator. The blow smashed the generator and a violent explosion followed. The breaking of the generator blew out every circuit and wrecked all the dynamos which were running. Following the explosion, fire started and gutted the building and destroyed the eight dynamos, or rendered them useless. The dynamos, it is reported, were the property of the Westinghouse Electric and Manufacturing Company, as the traction company had never accepted them, and the Westinghouse company were running them at their own expense, pending some decision in the matter.

The "Electrical Review's" New Representatives.

Owing to a most gratifying increase in business and the encouraging prospects of industrial revival, the Electrical Review has established two new offices in charge of competent representatives.

Mr. Carl E. Kammeyer, who is well and favorably known to the electrical fraternity, will hereafter represent this paper in the West, with offices at 1627 Monadnock Block, Chicago.

Mr. Henry W. Hall, 42 Old Broad street, London, E. C., will represent the Electrical Review in Great Britain, and will receive news, subscriptions and advertisements.

We bespeak for both these gentlemen the courteous treatment which has always been accorded to representatives of the Electrical Review.

Binghamton General Electric Company Sold.

Tucker, Anthony & Company, of Boston, have purchased control of the Binghamton General Electric Company, of Binghamton, N. Y. The capital stock of the company is $280,000, and the bonded debt $280,000, of which $255,000 is outstanding. Its business is almost entirely confined to lighting, and at the present time it furnishes over 8,000 incandescent lights and 500 arc lights. It is not proposed to put any new capital into the concern, as it is and has been for some time a well paying property. The General Electric Company and Street Railway and Illuminating Properties owned a majority of the stock of the company, and they have sold their entire holdings.

Decision on an Electric Heater Switch.

Referring to the article under this head published in the Electrical Review for March 3, the Consolidated Car Heating Company, of Albany, takes exception to the way the matter was presented. In a letter to the Electrical Review the company states "that the decision affects nothing but the use of a particular kind of indicator on a switch, and it has nothing to do with the electric heating system, or with the switch itself, or the combinations, but merely the indicator, and if the indicator is changed, infringement is avoided. Further, the case is appealed to the Court of Appeals, where we are confident that this decision will be reversed."

The entire plant of the Gladstone, Mich., Electric Lighting Company, has been destroyed by fire. The plant was owned by General Manager Kendrick, of the Great Northern Railway, St. Paul, and John Woods, of Minneapolis. Insurance small. It is a question whether the plant will be rebuilt.

TELEPHONE NEWS AND COMMENT.

The New York Telephone Company, of New York city, is reported to have bought a plot of several lots in Gold street, near Fulton, at about $750,000, upon which it will put up a sub-station, to be opened in connection with that at Cortlandt street.

The following directors of the Commercial Cable Company were elected recently: John W. Mackay, James Gordon Bennett, Gardiner G. Howland, Col. William Jay, George G. Ward, Sir William C. Van Horne, Edward C. Platt, Sir Donald A. Smith, Charles R. Hosmer, Thomas Skinner, Clarence H. Mackay, Albert B. Chandler and Dumont Clarke.

The City and Suburban Telegraph Association, which controls the Bell telephone system of Cincinnati and vicinity, is noted for the excellence and convenience of its telephone directories, which correspond in these respects to the quality of the service the company supplies. The latest issue of this company's directory, that for March, has been prepared with especial reference to completeness, accuracy and detail. The effort has been successful.

The American Bell Telephone Company, Boston, Mass., instrument output statement for the month ended February 20, is as follows: Gross, 19,680 against 18,090. Same month last year, returned 8,015 against 7,233. Net, 11,665 against 10,857. December 21 to February 20, gross output, 34,117 against 35,710; returned 14,416 against 14,801; net, 19,701 against 20,909. Total number of instruments outstanding February 20, 1897, was 791,990 against 697,445 a year ago.

Lewis Brown, father of Lewis Edward Brown, of Tuckahoe, N. Y., who was killed at Unionville by a stroke of lightning last September, has settled his claim against the New York Telephone Company for the death of his son, and the case has been withdrawn from the Supreme Court calendar. Mr. Brown accepted $3,500 in settlement of a claim for $20,000. Mr. Brown asserted that the telephone company was responsible for his son's death, as the lightning followed the telephone wire, which had no ground wire. Young Brown was spending his vacation at Unionville. A storm came up while he was sitting with others in Alfred Cox's store. Brown sat on a barrel near the telephone. He was talking about his return to business on the coming Monday, when his vacation would have come to an end. Just then the building was illuminated by a vivid flash of lightning, which was followed by a deafening crash, and Brown was killed.

What an Ad. Is For.

[*From the American Machinist.*]

An ad. has done its work when it has awakened interest, created a desire or provoked an inquiry.

Deaf Mutes and the Morse Telegraph Alphabet.

To the Editor of Electrical Review:

In your issue of February 24, Mr. C. C. Haskins tells why the plan to use the Morse telegraph alphabet, as a means of communication between deaf mutes, was found to be impracticable. He states that the scheme was suggested for use in the Delavan Asylum, Wisconsin, that the management and pupils were both much pleased with the idea, and that "only a few days elapsed before the alphabet was mastered and conversations were constantly going on between pupils"; but that two objections finally arose which condemned the scheme.

These objections Mr. Haskins states; and to the second one I wish to call attention. I quote from Mr. Haskins's letter: "After the lights were extinguished in the dormitories, the inmates had formerly nothing to do but go to sleep, but now they could and did talk by touch, and they were enabled to run from bed to bed and carry on a silent conversation, occasionally breaking out into a laugh, which discovered them."

That the pupils were made able to carry on conversations in the dark, and thus more nearly approached equality with those endowed with speech and hearing, would have been considered by most people, I am sure, to have been a great advance. However, the scheme was voted a failure, because it "became an annoyance and was subversive of order". We may fairly ask, if this institution was intended for the benefit of the pupils or the convenience of the management.

J. S. Codman.

Boston, March 3.

Mr. Carl E. Kammeyer.

[*From the Western Electrician.*]

Carl E. Kammeyer has formed a connection with the Electrical Review, of New York, by which he is the western representative of that journal, with an office in the Monadnock Building, Chicago. Mr. Kammeyer is well known to the electrical fraternity of the West. He is esteemed for his ability and integrity, and his friends' best wishes will follow him in his new departure.

CENTRAL ELECTRIC STATION OF THE DAVIS COAL AND COKE COMPANY.

BY TIMOTHY W. SPRAGUE.

The Davis Coal and Coke Company, large miners and shippers of bituminous coal, and manufacturers of coke in West Virginia, operating mines and ovens all along the West Virginia Central & Pittsburgh Railroad, from Piedmont to Elkins, is the first company in that entire region to adopt electricity in connection with any mining operations. At Thomas, in Tucker County, the company has two mines, one operated as a drift mine and the other by a shaft, the two seams mined covering practically the same territory. At Coketon, about two miles distant, are two other drift mines and three banks of coke ovens, comprising in all about 500 ovens. There are a few ovens at Thomas, also. The coal territory which is reached by the openings at Thomas and Coketon is of very large extent, and after a careful investigation it was decided best to locate the electric power station at Thomas, and make it a central distributing station for all these operations. This site was favorable also from the fact that a battery of boilers was already installed there for operating the shaft hoists and pumps, and a good water supply is available.

Fig. 1.—General View of Coketon Operations, Showing Davis Coal and Coke Company's Electric Transmission Line.

Accordingly, the boiler capacity was doubled and a substantial power house built about 200 feet from the boiler house. The power house itself is of brick, laid on heavy stone foundations. It is 49 feet 2 inches by 52 feet 8 inches in extent, and the walls are 14 feet high. The walls are reinforced by 4 by 18-inch pilasters, spaced 1 foot 5 inches apart, and large windows, 4 feet by 7 feet 8 inches, furnish good light. The roof is a steel truss structure, covered by three-inch matched strips and a fireproof roofing material. The inside walls and roof are painted white, and with the coach-black of the trusses present a very pleasing contrast, and at the same time make the interior very light. It is a fact, perhaps not generally recognized, that with a power house interior attractive in appearance and well lighted, the incentive for the engineer to keep the apparatus correspondingly clean and bright is a strong one.

The flooring is two-inch oak, laid on joists 12 by 2 inches, which are in turn supported by heavy floor timbers. The foundations for engine and generator are of solid masonry, extending some eight feet through the soil to bed rock, and are entirely separate and distinct from the building and floor foundations. The building is designed to contain at least three units of power generation, each of from 150 to 200 horse-power capacity. At present but one of these units is installed. It consists of a 15 by 21-inch simple engine made by the Atlas Engine Works, of Indianapolis, Ind., of a new type called the "Cycloidal". The engine is shown in the third illustration. Its foundation is covered by a capstone of native sandstone with beveled edge, on which the iron base-frame fits. The engine itself is of massive construction, weighing, complete, a little over 16 tons. It is operated on an initial pressure of 80 pounds per square inch, and runs at a speed of 200 revolutions per minute. The engine gets its name from the fact that the steam valves are operated for any port opening by the least motion of a simple cycloid. The exhaust valves are operated by a fixed eccentric.

The engine is belted to the generator by an endless double leather belt, 17 inches wide. The steam-pipe leading to the power house is designed to carry steam for the entire plant after additions are made. It is covered with an insulating material and leads into a separator immediately on entering the building. From the separator a smaller pipe leads to the engine, all piping having flanged fittings.

The generator, which runs at 900 revolutions per minute, and is of 100 kilowatts capacity, was manufactured by the General Electric Company, and is wound for a potential of 500 volts, three-phase alternating current. This type of machine was chosen on account of the long distances to which power will eventually be distributed, for which static transformers may later be required, and also because the three-phase motor offered some advantages in the work to which power was to be applied. The generator and its exciter are shown in the second illustration. From the generator the main leads, and also the exciter and rheostat leads, pass through the floor in heavy porcelain floor insulators and thence in conduits under the floor to the switchboard. They are carried on porcelain insulators, and are of best insulated cable, rubber covered and outside braided. The conduits are made perfectly tight, are painted with an insulating com-

pound and are accessible in all parts by means of trap-doors in the flooring.

The switchboard consists at present of two panels, one for the generator and the other a distributing panel. They are both of blue Vermont marble, with all connections on the back of board. The generator panel carries a station transformer, lightning arresters, three main cut-outs, ammeter, voltmeter, ground detector, main switch, exciter switch and two Carpenter enamel rheostats on the back of the board. The feeder or distributing panel carries 12 cut-outs and four circuit switches, two of 150 amperes capacity, one of 75 amperes and one of 30 amperes. The circuits from these switches are of heavy insulated cable for a distance sufficient to remove all possibility of short-circuiting by contact, and thence are of bare wire. When the house was originally designed it was the intention to carry all the circuits out through the north wall, which is directly back of the switchboard, and a wire arch, which is partly shown in the illustration, was placed therein. Afterward, when a change in the applications of power and location of circuits was made, more lines running south from the power house were needed; hence the number of circuits to six and one-half feet. Seven machines have been installed, four of the longer type and three of the shorter. They make a full undercut in from three and one-half to four minutes in this coal and withdraw in 12 seconds.

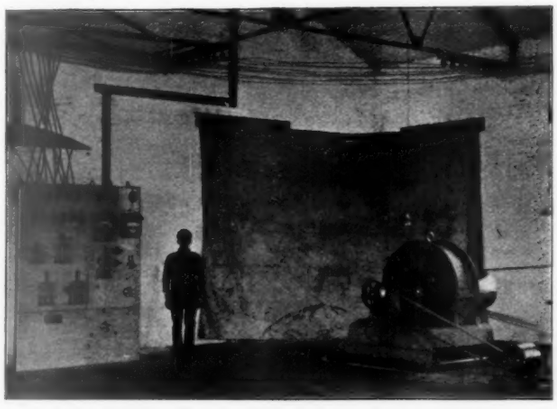
The company has found it most advantageous to do the undercutting on a bench, about half way up the seam, which averages from six to eight feet in thickness. The machine makes its first cuts in forming the bench on an adjustable truck, and these trucks also take the machines readily off the bench for transportation to the next room. When cutting on the bench the upper part of the seam is shot down, and later the end of the bench is shot up. This plan has been proving very satisfactory during the time it has been in operation. The coal shoots more easily after the bench cutting than when the cutting was done on the floor, and more lump coal is obtained. It is estimated that the machine mining gives one-fifth more lump coal than pick mining.

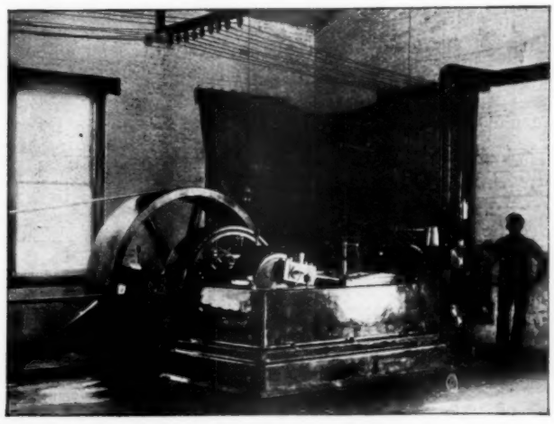
The shooting and loading of the machine mined coal is at present contracted on a basis of a little over 50 per cent of the price paid for pick mining. The machines, when operated to their capacity, yield from 125 to 150 tons run-of-mine coal per machine per shift. Three machines are intended to be run on the right and three on the left, leaving one always in reserve. The company has adopted a rigid system of inspection, and the record of repairs of each machine is carefully kept. A repair shop, which is supplied with current, has been fitted up near the bank mouth, where the machines can be run in on their mine trucks; in it also is the carborundum grinding wheel on the armature shaft of a one-horse-power induction motor, which is used for sharpening bits. The cutters are equipped with 10-horse-power induction motors and their design places all gearing under the motor, where the gun-metal shield of the motor protects it thoroughly. The motors will develop 20 horse-power with safety, and the machine itself is mechanically well able to bear a greater strain. The first cutting done was in a "horse-back" bone formation, which is extremely hard and ground the bits in short order, but the motor and driving gear were equal to the strain. The bits on this machine are fitted into curving sockets, so that nearly all the stock in the bit can be utilized, and the grinding and shaping is a very simple matter.

The old method of operating the elevators at Thomas was by means of a wire-rope transmission from a slide-valve steam engine. The rope led from the engine pulley to the first elevator tower, and by means of a clutch the rope leading to the second tower could be thrown in. The result was a great deal of vibration in the towers and great loss by friction and slip. As at present arranged, a five-horse-power motor is geared with double speed reduction to the smaller elevator, having a duty of raising 400 tons slack, per day of 10 hours, about 50 feet. A 10-horse-power motor for the shaft elevator has a proportionally heavier duty. The motors have been in constant use since first started, and have been responsible for no delays in this part of the plant. They are of the induction type, with no commutators nor brushes, an important feature, as they are placed where it is necessarily exceedingly dusty. They require no attention beyond an occasional oiling and inspection, and are effecting a large saving over the former cost of operating these elevators. As no rheostats are required for starting these motors, the only apparatus used beside the motor is a three-pole switch and cut-out.

From the power-house a circuit is carried to Coketon, nearly two miles southwest. The poles for this circuit, also used by the right coal-cutting circuit as far as the manway, are 30 feet eight-inch poles, firmly set six to eight feet in the ground, placed at distances of about 125 feet apart, and carry two 4-pin cross-arms. The top of the pole also carries a pin, so that the two cross-arms and this pin provide for three circuits. These lines and, in fact, all the outside lines and apparatus are thoroughly protected from damage by lightning by Wirt lightning arresters, of which 45 altogether are in use.

At Coketon, as shown in the first illustration, the company has a very extensive coke plant. The first bin shown on the right is called No. 3, and the middle bin No. 2. Each of these bins has a capacity for holding about 800 tons of slack. The larries run under them and are charged from the charging doors, of which there are several for each bin. The bins are in size about 30 by 50 feet, and 67½ feet high, with an inverted pyramid bottom. No. 3 takes slack from the tipple just below it, and No. 2 from the tipple on the extreme left. Connecting the two is a truss bridge, over which a conveyor runs. Both these elevators and the conveyor are operated by motors, all three being of 20-horse-power capacity each. The conveyors are of the oblong flight type, put in by Heyl & Patterson, of Pittsburgh. The motor which runs the horizontal conveyor is in bin No. 2. It is controlled by a double-throw switch, which is all that is necessary to obtain the reversal which is required in this conveyor. The heads and chutes are so arranged that either elevator can be made to feed into its bin or into the conveyor, the change requiring no delay, and as the conveyor can be reversed inside of a few seconds, the slack from either mine can be put in either bin at a moment's notice. This arrangement does away with the necessity for running both mines in order to get slack for both lines of ovens. One man looks after the motors and the manipulation of the chutes, etc. The saving effected by means of this method of operating can not be estimated, as the bins are both new and their elevators were never operated by any other means; but it can readily be seen that it is considerable, aside from the convenience and the freedom from risk of frequent shut-downs. The elevators are not necessarily in constant operation, and if worked by steam, several hours' notice would be required before starting, or else steam would have to be kept up at all times. Now all that is necessary to start any or all the apparatus is the throwing in of one or more switches. During the trial of one of these elevators, when everything was rough and friction very great, a test was made as to what load the motor would carry, and it was found to stand a load of about 100 per cent more than its rating.





FIGS. 2 AND 3.—SWITCHBOARD, GENERATOR AND ENGINE, DAVIS COAL AND COKE COMPANY'S CENTRAL STATION.

which are carried through the house on the roof trusses as shown, and pass out through porcelain tubes over the window, as shown in the first illustration. These wires were not permanently placed when the photograph was taken, hence their rather ragged appearance.

The power is at present used in coal cutting and the operation of five elevators and conveyors. The coal-cutting circuits run distances of a little over half a mile in two directions in the drift mine, approximately north and south of the power house. The north circuit passes in through the air course, and keeps in the air course all the way to the face, except for a short distance, where it is run along the main left haulway, partly along the roof and partly in a channel along the rib. Junction boxes are placed on the line near the face, from which connections are made to the machines through heavily insulated cables. These boxes are so located that two or more rooms can be reached from one box.

For the right or south side the current is carried overland for about half a mile, entering the mine through a newly opened manway. Thence it branches and covers a considerable territory along the main and cross entries. The junction boxes are installed here as on the north. The cutters are operated by three-phase induction motors. They are of the chain pattern, made to cut a kerf 39 inches wide and five inches high, to a depth of from five and one-half

The illustration shows the pole line leading north toward the power station. The main line of the West Virginia Central Railroad runs between bins No. 2 and No. 3.

It is probable that the use of electric power will be further extended in the Spring and utilized for haulage, pumping, ventilating and other purposes.

The writer is indebted to Mr. F. S. Landstreet, general manager of the company, and Mr. W. R. Davis, assistant manager, for information kindly furnished regarding the operation of the plant, and also for the photographs from which the illustrations have been made.

Armory Lighting in New York City.

The Armory Board met in the Mayor's office on March 1 to award several small contracts for furnishings for the new Ninth Regiment Armory, on West Fourteenth street, New York city. The bid of the Commercial Construction Company, aggregating $24,000, for the lighting of the Seventh Regiment Armory with electricity was rejected. Bids will be advertised for again. The bid was rejected because the bidder is a comparatively new concern, it is alleged, and has never had any large contracts to carry out.

CONDUCTIVITY OF INCANDESCENT CARBON FILAMENTS AND OF THE SPACE SURROUNDING THEM.

READ BEFORE THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, NEW YORK, FEBRUARY 17, AND CHICAGO, FEBRUARY 24, 1897, BY JOHN W. HOWELL.

The first part of this paper, which relates to the conductivity of carbon filaments, is in the nature of a discussion of a paper read before the

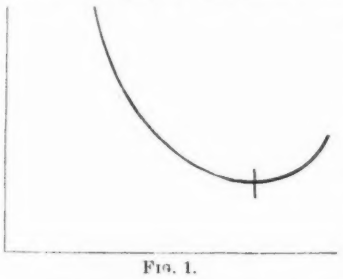


FIG. 1.

institute by Professor Anthony at the May meeting in 1887.

Professor Anthony spoke of a change from negative to positive of the temperature coefficient of some carbon filaments which he had observed. He illustrated the change by a figure which I will reproduce here for reference.

Professor Anthony stated that this change did not occur in all filaments, and that he was unable to explain the circumstances under which it did occur.

Prof. Elihu Thomson, in his discussion of Professor Anthony's paper, said that he had observed the same phenomenon, but had not investigated it sufficiently to explain its cause.

About four years ago an inventor offered to the General Electric Company a method of coating carbon filaments with metal, claiming thereby a very great improvement in the performance of the filaments. The metallic coating was applied by heating the filament to high incandescence in the presence of the vapor, which was obtained from a very thick dark-colored liquid, the application being made by the same means as is employed in the ordinary hydrocarbon flashing process. The proof which he gave that his filaments had a metallic coating was the fact that the resistance of these filaments was lower at about red heat than it was at higher temperatures.

In order to test his assertions, I treated a number of filaments with his dark liquid, and, for a comparison, treated in exactly a similar manner a number of similar filaments, using ordinary gasoline. To the surprise of both of us, the gasoline filaments showed the same rise in resistance, after passing the dull red temperature, as was shown by the filaments supposed to have a metal coating. This fact led me to investigate this phenomenon.

I had previously made resistance curves of a great many Edison lamps, which had filaments made without hydrocarbon flashing, and I knew that the filaments of all these lamps continued to fall in resistance to the highest temperature which they would stand. As we had very recently adopted the hydrocarbon treatment upon our filaments, I associated the change in the resistance curve with treated filaments. The filaments, which I have previously described as having the reverse curve, were quite heavily treated. I now made a set of 10 lamps with various amounts of treatment, all made from similar base filaments. These lamps had filaments the resistances of which, when cold, were 90, 80, 70, 60, 50, 40, 30, 20 and 10 per cent of the cold resistance of the original base.

I found, upon plotting the curves of these filaments, that the untreated filament fell in resistance as it was made hotter, and that this fall continued to the highest temperature at which I dared run it.

The slightly treated filament fell in resistance more rapidly than the untreated filament at first, and less rapidly as the high temperatures were reached, its curve finally rising above that of the untreated filament. As the amount of treatment is increased, the curve falls more and more rapidly at first, and less rapidly at the higher temperatures. When we reach the filament treated to 50 per cent, we find that it falls rapidly to about 50 per cent of its cold resistance, and remains practically constant at higher temperatures. The curves of filaments treated to less than 50 per cent all rise after reaching their lowest point, which is reached at about 50 per cent of their three watts per candle voltage.

These curves show the changes in resistance of these filaments. The ordinates are percentages of the cold resistances of the various filaments, so that all curves start from the 100 per cent mark. The abscissæ are percentages of the voltages at which the various lamps take three watts per candle. The bottom curve on this sheet illustrates the resistance curve of a carbon filament which had been treated to about one per cent of its original resistance. This made a filament which was nearly all treatment. This curve shows an increase in resistance from its lowest point to the last point obtained of about 25 per cent.

This lamp was measured at the Edison laboratory by Mr. Kennelly and myself. The readings were very carefully taken upon very sensitive instruments, and there can be no doubt as to the accuracy of the curve, as it agreed very well with the measurements I had previously made upon the same filaments. These curves can be obtained a good many times from the same filaments, so there is no permanent change in the filaments which in any way accounts for the rise in resistance. The cold resistance of the filaments, after being measured, were found to be same as before any measurements were made.

These same 10 carbons were taken from the lamps and put into a baking oven, the temperature of which could be regulated very nicely by an electric heater. These filaments were heated to about 500 degrees Fahrenheit, the temperature being measured by two mercury thermometers. The resistance curves obtained in this way are shown on the upper part of the sheet, and agree quite well in character with the resistance curves obtained by measuring the volts and amperes of the lamps, so there is no doubt that the changes in resistance are due to temperature, and to nothing else.

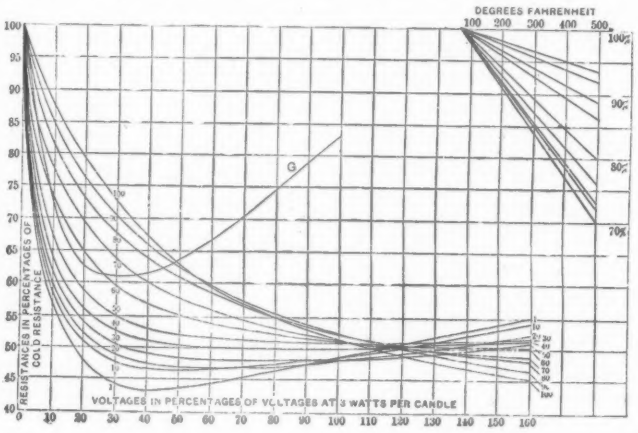

DEGREES FAHRENHEIT
100 200 300 400 500
RESISTANCES IN PERCENTAGES OF COLD RESISTANCE
VOLTAGES IN PERCENTAGES OF VOLTAGES AT 3 WATTS PER CANDLE
G

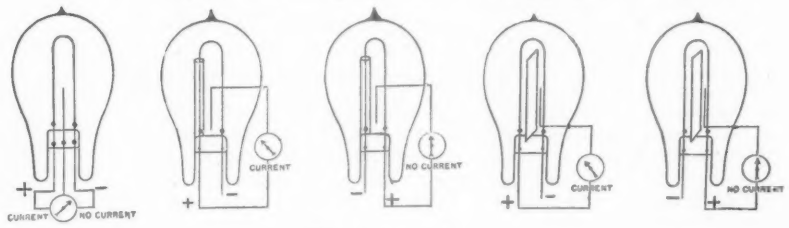
FIG. 2.—CURVES SHOWING CHANGES OF RESISTANCES OF LAMP FILAMENTS WITH VOLTAGE AND TEMPERATURE.

I then obtained untreated base filaments from as many kinds of amorphous carbon as I could obtain, and plotted their resistance curves.

I tried filaments made of bamboo, silk, cotton, cellulose (made by the ordinary squirt process), tamadine and paper. All of these base carbons gave the same curve, and all of them continued to fall in resistance as long as I was able safely to increase the temperature.

These carbons were quite different in their physical characteristics. The silk filaments were the most porous, and had the roughest and the best heat radiating surface, while the tamadine filaments were very dense and had a very highly lustrous surface.

FIG. 3.



FIGS. 4, 5 AND 6.

I was entirely unable, for a long time after making these curves, to come to a satisfactory theory regarding them. The reverse curve is not caused by changes in the characters of the surfaces of the carbons, due to emissivity, because no corresponding changes in emissivity occur.

I made observations upon untreated and heavily treated filaments, to see if they acted differently in regard to their expansion with heat, thinking that possibly the changes in the resistance curve may have been caused by a change in the expansion curve with temperature. These observations were not very refined, being simply observations made by means of a telescope, but they showed clearly that all of the carbons expanded with heat, and apparently there was no difference in this respect.

It has been the custom for some time to speak of the carbon which is obtained by the treating process as graphite carbon, and knowing that Mr. Edison had, in 1881, made some filaments of graphite by pressing the pure graphite, under very great pressure, into the form of loops, I was very anxious to obtain a lamp containing one of these filaments, to see whether it would have the same resistance curve as the other forms of untreated carbon. I have very recently obtained one of these lamps from Professor Barker, of the University of Pennsylvania, and upon plotting its resistance curve I was very much pleased to find that it had the same characteristics as the heavily treated filament. It reached its minimum resistance at a dull red heat, and from this point, as the temperature was increased, the resistance increased also. This curve is marked G upon the sheet on which the other curves are plotted.

It will be observed that the resistance curve of this filament does not fall as much as the other curves, and rises much more. This may be due to the different natures of the two kinds of graphite or to structural differences. The top of the loop of the graphite filament got much hotter than the rest of it; this would cause this part to start rising before the rest had ceased falling in resistance, and this may account to some extent for the less total fall in resistance of this filament. The resistance of this filament, after the measurements had been made, was just the same as before they were made. This indicates quite clearly that our calling the treated carbon "graphitic" is correct, and that the change in the resistance curve of treated filaments is due to the graphitic nature of the layer of carbon which is put on during the treating process.

The graphite filament lamp referred to is shown in Fig. 3.

The second part of this paper, which relates to the conductivity of the vacuous space surrounding incandescent filaments, may be considered as a discussion of the paper upon the "Edison Effect" in incandescent lamps, which was read before the institute by Professor Houston in October, 1884, and which was the first paper read before this society.

"Edison Effect" is the name given to the effect produced by those currents, first observed by Mr. Edison, which pass from one leg of an incandescent filament across the vacuous space to the other leg, and which can be observed by connecting a galvanometer between the positive lamp terminal and a wire sealed into the bulb and projecting into the vacuous space.

Fig. 4, which is taken from Professor Houston's paper, serves to illustrate Mr. Edison's original experiment. The galvanometer indicates a current flowing from the positive lamp terminal through the galvanometer and third lamp wire, and through the vacuous space to the negative leg of the incandescent filament. If the external connection of the galvanometer be changed from the positive terminal to the negative terminal, no current will flow through the galvanometer. This effect can be observed in the most highly exhausted lamps. A lamp so highly exhausted that it

shows no glow when tested with an induction coil, giving a spark three-quarters of an inch long, will allow a current sufficiently large to show plainly on a not very sensitive galvanometer to pass through its vacuous space. This current increases as the temperature of the filament is increased, but in a well exhausted lamp is never greater than a very few milliamperes, when the lamp is burned at about two and one-half watts per candle.

In 1884 Mr. Preece secured from Mr. Edison some lamps having wires sealed into the bulbs, and read a paper before the Royal Society describing some experiments made upon them, illustrating the "Edison Effect."

Professor Fleming read a most elaborate paper before the Physical Society, of London, in March, 1896, upon this same subject. Professor Fleming's experiments proved that in well exhausted lamps the vacuum is not a conductor in the ordinary sense of the word, and that the current which passes through it is carried by negatively charged molecules, which pass constantly from the negative leg of the incandescent filament to the positive leg and to any inserted wire, thus bringing the inserted wire to the same potential as the negative leg. Professor Fleming also proved that these molecules pass in straight lines, and that their passage is completely, or almost completely, stopped by a glass or mica screen placed between the negative leg and the inserted wire. The following experiments serve to illustrate these effects:

Fig. 5 shows a lamp having a glass tube surrounding one leg of the filament, and a wire sealed in the side of the bulb, which projects into the center of the vacuous space. When the leg of the filament which is in the glass tube is made positive, and the filament heated to about a two-and-one-half watts per candle temperature, the galvanometer, which is connected between the wire and the positive lamp terminal, shows a strong deflection; but when the leg in the tube is made negative, the galvanometer, being, as before, connected between the wire and the positive lamp terminal, shows no deflection.

Fig. 6 shows a lamp having a platinum plate two and one-quarter inches long and three-quarter inch wide between the legs of the filaments, and a wire inserted in the vacuous space. I also used lamps having a similar plate made of glass, similarly placed. In both of these lamps, when the vacuum was high, no current was produced between the wire and the positive terminal when the wire was shielded from the negative leg; but shielding the wire from the positive leg made no hindrance to the passage of the current. The facts that no current flows when the galvanometer is connected between the negative terminal of the lamp and the inserted wire, and that a shield between the positive leg and the inserted wire has no effect upon the current, show that positively charged molecules are not emitted by the positive leg, while the screen effects, just described, show that the negatively charged molecules pass in straight lines.

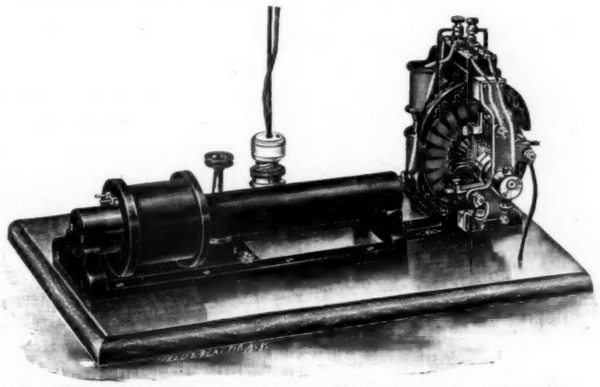
(To be continued.)

Wants To Complete the Road.

On petition of G. H. Condict, receiver of the Chicago & Englewood Electric Railway, the court has authorized the issue of receiver's certificates to the amount of $323,000, of which $60,000 is of series A and $263,000 of series B. The money will be used to pay off liens against the property and to complete the installation of the road's storage battery system.

The Edison Direct-Current Cautery Transformer for 110 to 120-Volt Circuits.

This apparatus, illustrated herewith, is designed to enable the direct 110 to 120-volt Edison current to be used with absolute safety for electro-cautery work, and will be found of the greatest assistance to those physicians whose offices are equipped with this current. It is also suitable for hospital work, as many of the most prominent institutions are lighted by



THE EDISON DIRECT-CURRENT CAUTERY TRANSFORMER FOR 110-120 VOLT CIRCUITS.

direct current. The apparatus consists of a 120-volt Edison motor, the armature shaft of which is provided with two collecting rings, which are connected to the armature at points diametrically opposed.

The current taken from these collecting rings, which is now of an alternating character, is led into the primary circuit of the transformer, shown on the left of the cut. The primary circuit is composed of a number of turns of fine insulated copper wire, wound round a core of annealed iron wires, the whole being inclosed in a thin cylindrical shell of hard rubber, which is supported by a hard-rubber standard at each end. The secondary coil, composed of a few turns of thick wire, is wound on a hollow hard-rubber spool operated by a rack and pinion movement and sliding over the primary coil. The terminals of the secondary coil are brought out to two pin attachments mounted on one head of the coil, and the cautery cords are connected thereto by split socket connections. On moving the secondary coil to the right, the current is increased, and *vice versa*. The apparatus is mounted on a highly polished oak base and is provided with an attachment plug and 10 feet of flexible cord for connecting the instrument to the mains. The apparatus is manufactured by the Edison Manufacturing Company, 110 East Twenty-third street, New York city.

An Automatic Return Telephone Switch.

The usual switch adopted in connection with interior or intercommunicating telephone systems requires that after the speaker has made the connection and wishes to disconnect, it is necessary to turn back the indicator by hand each time. This is frequently forgotten, causing much annoyance, as the instrument remains in circuit with the last number, and does not respond to other calls. A new device, known as the "automatic home switch," which is claimed to overcome this difficulty, has just been perfected by the Mianus Electric Company, Mianus, Ct.

When the receiver is returned to the hook for disconnection, the switch is released and the indicator flies back to the home number, as, for instance, Station 5 wishes to talk to Station 9. The switch is turned to 9 and the bell rung. Station 9, when through, places receiver on the hook, automatically releasing the switch, which returns to 5. The device is shown in the accompanying illustrations.

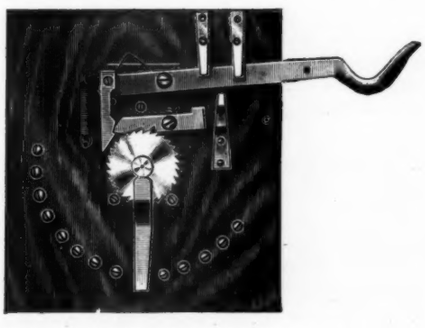


FIG. 1.—REAR VIEW, AUTOMATIC HOME TELEPHONE SWITCH.

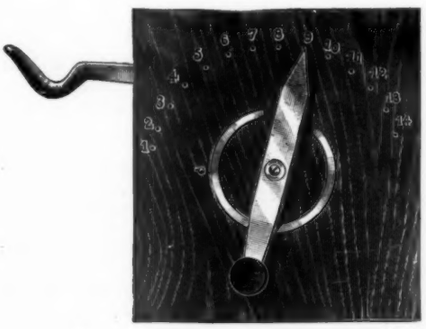


FIG. 2.—FRONT VIEW, AUTOMATIC HOME TELEPHONE SWITCH.

The Bryan-Marsh Company's new and attractive Chicago offices, in charge of the affable J. M. Hill, are among the handsomest quarters in Chicago. The rather original treatment of the windows, in placing the signs of aluminum letters on a maroon background, is especially striking, and elicits much favorable comment.

ELECTRIC RAILWAY NOTES.

The Metropolitan Elevated Railroad, of Chicago, carried 57,000 passengers on March 1.

Judge Smyth has signed a decree ordering the foreclosure of the mortgage against the Burlington, Iowa, Electric Street Railway Company. This foreclosure suit was brought by the American Loan and Trust Company, the purpose being to dispose of the property of the railway company and to form a new company with increased capital stock and additional business investments. Over $1,000,000 is involved in the case. There is $300,000 in first mortgage bonds held by the above trust company, $120,000 second mortgage bonds and $600,000 in stock.

A long bill, introduced by Representative Davis, of Utica, Mich., provides for giving to the electric railway companies the same rights to condemn private property for right of way as is now exercised by steam railway companies. At present there is no provision for giving electric roads right of way along any route, except on streets or highways. The bill is intended to apply to all parts of the State, but originates in Mt. Clemens, with some of the movers of a plan to connect Detroit with Utica, Romeo, Imlay City and other towns directly north of Detroit.

Senator Henry Zimmer, of Kansas City, has introduced a bill in the Senate to compel street-car companies to make a reduction in fares during certain hours in the day. The bill was prepared by a committee from the employés of the packing houses of Kansas City, Kas. These men want to ride to and from their work for three cents. The bill provides that between the hours of 5 and 8 A. M. and 5 and 8 P. M. street-car companies in any city shall not charge more than three cents for fares. Any company violating the measure and charging more will be guilty of a misdemeanor and fined not less than $5 nor more than $25 for each offense. Senator Zimmer also has a bill which makes it a misdemeanor for any street-car company to compel employés to put up a bond, or for any company to withhold a part of the employés' wages as a bond for honesty. The penalty provided in the bill is a fine of not less than $15 nor more than $100.

ADVANCE INFORMATION

Electric Light and Power.

COMMERCE, TEX.—The Commerce Improvement Company has been organized, with W. W. Rutland, president; O. C. Mulkey, secretary, and W. J. Taylor, treasurer. The company will build an electric light plant, etc. Capital stock, $50,000.

WHEELING, W. VA.—City Clerk may give information concerning electric light plant.

WILMINGTON, N.C.—The Wilmington Gas Light Company is putting in new machinery, including a 300-horse-power engine, dynamo, etc.

NEOLA, IOWA—City Clerk may be addressed concerning proposed establishment of an electric light plant, at a cost of about $3,500.

WOLFBOROUGH, N. H.—Town Clerk may be addressed concerning construction of electric light plant.

BARABOO, WIS.—City Clerk may be addressed concerning establishment of a $20,000 electric light plant.

WATERLOO, OHIO — An electric light plant is to be established.

PORTLAND, ORE. — I. S. Geer & Company and N. Brown & Sons have been granted a franchise to establish in Burns, Harney County, an electric light plant and waterworks.

PORTLAND, ME.—The electric plant at Smelt Hill, Falmouth, has been added to the Westbrook Electric Light and Power Company, the whole now being under the management of Mr. E. B. Newcomb as superintendent.

NORWAY, ME.—A syndicate, consisting of Hon. Geo. E. Macomber, Hon. John F. Hill, of Augusta; Hon. Fred. E. Richards, of Portland, and Hon. H. L. Shepherd, of Rockport, have purchased the plant of the Norway Electric Light Company.

COLEMAN, MICH.—Citizens of this place are considering the question of electric lights for their town.

EAST JORDAN, MICH.—A local stock company is to be organized at this place, for the purpose of putting in and operating an electric lighting plant in the village.

IDAHO SPRINGS, COLO.—Frederick A. Moss, Jacob J. Elliott, Henry Plummer and James M. Ireland, as incorporators, have filed with the Secretary of State the certificate for the incorporation of the Idaho Springs Electric Light, Power and Heating Company, with a capital stock of $30,000.

MEMPHIS, TENN.—Mayor will give information concerning erection of electric light plant.

JONESBORO, TENN.—R. F. Wells contemplates the establishment of an electric light plant.

DECATUR, MICH. — An electric light plant will probably be established.

SAUGUS, MASS.—Town Clerk may be addressed concerning electric lighting plant.

LITCHFORD, CT.—Grannis & Elmore have let contract for their electric light plant, and expect to have it in operation by March 15.

EXCELSIOR SPRINGS, MO.—The Excelsior Springs Gas and Electric Company has been incorporated by J. B. Forbis and others, to build a plant. Capital stock, $2,000.

REDWOOD FALLS, MINN.—A. C. Burmeister has been granted franchise to construct and operate an electric light plant.

MADELIA, MINN. — An electric light plant will probably be established.

HARTFORD, CT.—The Housatonic Power Company has been incorporated.

New Telephone Companies.

CAMDEN, TENN.—A new telephone line is being constructed between Saltillo and this place, via Scott's Hill and Sugar Tree, giving connection with long distance 'phones to Nashville and Memphis.

FOREST GROVE, ORE. — Anton Pfanner intends to build, this Spring, a telephone line from here to Hillsboro.

LOS ANGELES, CAL.—The Home Telephone Company, by F. W. Braun, president, has filed with the City Clerk an application of a franchise to operate and maintain a telephone system in this city.

FREDERICKSBURG, VA.—Judge W. S. Barton, of the Circuit Court, has granted a charter incorporating the Rappahannock, Fredericksburg and Piedmont Telephone Company, of this city and State. The officers are W. S. White, president; M. G. Willis, vice-president; H. F. Crismond, secretary, and Ed. D. Cole, treasurer. Directors—W. S. White, E. D. Cole, M. G. Willis, H. F. Crismond and A. P. Rowe, Jr.

New Electric Railways.

AMHERST, MASS. — Amherst-Sunderland Street Railway Company; work will shortly commence on construction of electric road from Boston & Maine Railroad station. Twenty thousand dollars has been practically subscribed for.

NEW BRITAIN, CT.—The Central Railroad Company has been incorporated to construct an electric road.

NEWBURYPORT, MASS.—The Haverhill, Merrimac, Amesbury Street Railway have been granted permission to erect poles and equip with electricity a branch of the present system, now operated by horses, from Salisbury Square to the New Hampshire line.

ST. LOUIS, MO.—The Shaw Avenue Electric Railway Company has been incorporated. Chris Von der Ahe, Charles E. Wehner and J. W. Peckington are the incorporators. Capital stock, $20,000.

PORTLAND, ME.—The Portland & Yarmouth Electric Railroad Company have signed and delivered to the County Commissioners the permission to cross Martin's Point Bridge, and will begin making the changes on the bridge in a few days. The directors of the Portland & Yarmouth Railroad have organized, with Quincy Browne, of Boston, as president, and W. G. Whelden, of Boston, treasurer.

VICKSBURG, MISS.—The canvass for the proposed subscription of $20,000 to the bonds of an electric street railroad company is progressing favorably, and other improvements are in contemplation.

CORSICANA, TEX. — Woodford Brooks, of Fort Worth, treasurer of the Glenwood & Polytechnic College Street Railway Company, of Fort Worth, and of the Hillsboro Electric Street Railway Company, is discussing the advisability of putting in an electric street-car line in this place.

AYER, MASS.—City Clerk may be addressed concerning proposed erection of new electric railroad.

BOSTON, MASS.—A party of Boston capitalists, of which Mr. John Graham is the leader, has recently organized a company for the purpose of constructing a new electric street railway line from Forest Hills to Neponset, where it will connect with the Quincy & Boston line. The new corporation is capitalized for $100,000, and it is hoped to be able to commence construction work early in the Spring.

TITUSVILLE, PA.—A franchise for the construction of a street-car line in this city has been granted by councils to an electric traction company. The proposed line will extend to Pleasantville and Hydetown, and the time to complete the line is limited to one year from date of the granting of the franchise.

Increase of Capital.

PHŒNIX, ARIZ. — The Phœnix Light and Fuel Company has increased its capital stock to $500,000.

ROCHESTER, N. Y.—The Citizens' Light and Power Company has increased its capital stock from $150,000 to $400,000.

OYSTER BAY, L. I.—The capital stock of the Oyster Bay Electric Light and Power Company has been increased from $15,000 to $25,000.

PORTSMOUTH, N. H.—The Portsmouth & York Beach Electric Railroad Company has increased its capital stock from $50,000 to $200,000.

New Incorporation.

CHICAGO, ILL.—The Safety Car Gate Company has been incorporated; capital stock, $25,000; for manufacturing. Incorporators, Andrew S. Littlefield, Louis E. Myers, William C. Pullman, David J. Evans and Albert S. Hewes.

Business Troubles.

SALT LAKE CITY, UTAH.—The Payson Electric Light and Manufacturing Company has assigned to T. G. Wimmer, of Payson.

The Adams-Bagnall company, through its Chicago representative, Mr. J. G. Pomeroy, secured the order for furnishing the arc lamps for the new Masonic Temple, at Dixon, Ill.

ELECTRIC RAILWAY WORK IN CHICAGO.

TRACTION PROGRESS IN THE CITY BY THE LAKE.

From present indications, it is safe to say that this year will see an unusual activity in elevated and surface road construction in Chicago. On the first of the month work was resumed on the Northwestern elevated, and all the steel now on the ground will be raised without further interruption. Only about a mile of foundations remains to be laid, and the only thing liable to delay the opening is the building of the power house, which will be the largest power station in Chicago. It will be located on the Evanston branch of the Chicago, Milwaukee & St. Paul Railroad. Its dimensions will be over 300 feet long by 250 feet in width. At least a year will be required for its completion, and, as nothing has been done on the site, the road will probably not be ready for operation before the Spring of next year.

The Union L loop, according to present calculations of the engineers, will be ready for operation by May 1. The connection between the loop and the Metropolitan L is progressing rapidly, the structure from Fifth avenue to the Metropolitan line on Market street is expected to be finished next week, and by the first of the month the Metropolitan will probably find a terminal in Wabash avenue. Cables for feeders are now being strung. The Lake Street L is at present furnishing its own current on the loop, and the Metropolitan will be compelled to do likewise, as the Union company's power house will not be finished for some time, on account of the delay in getting the structural iron, which, on account of the extraordinary weight required to be carried, has to be made on special lines.

The South Side L road is having an ordinance prepared, granting permission to build its connection to the loop in Harrison street, and as soon as the ordinance is granted, the block of structure will be erected. Probably June 1 will see the operation of the three roads around the loop. The South Side L, having the privilege of using steam power for two years, will not equip its line electrically, until the advantages of the loop have been demonstrated to the company's entire satisfaction.

Among the surface roads, the General Electric Railway Company is planning to cut into the territory of its rival, the Chicago City Railway, and will probably, within a short time, ask the city council for rights of way, extending south from Wabash avenue and Sixty-third street to points near Jackson Park, and fully covering Englewood. The Englewood territory will be covered by branch roads, it is asserted, extending westward from the main trunk line in Wabash avenue. Branch roads will also be projected south and west from the trunk line in Wabash avenue, and to parallel the lines of the Chicago City Railway Company.

Kindred.... ...Interests

The Brown Electric Company, of Chicago, has changed its name to the Anglo-American Electric and Manufacturing Company.

The General Incandescent Arc Light Company, New York city, is sending out a well printed pamphlet illustrating and describing the 1897 styles of Bergmann long-life inclosed arc lamps.

The Electrical Exchange, of Chicago, last week, received a shipment of several car loads of electrical machinery, which it will dispose of in a short space of time, judging from the number of inquiries the company is receiving for all kinds of bargains in the electrical line.

The General Electric Company has issued from its own printing establishment at Schenectady, N. Y., a handsome catalogue of its electric pumping machinery. The catalogue comes from the power and mining department, and includes illustrations and descriptions of electric pumps for every service.

The Clonbrock Steam Boiler Company, Brooklyn, N. Y., are sending out to their friends and customers a tasteful catalogue of the Morrin "Climax" water-tube safety boiler. The frontispiece of the catalogue is a reproduction of the diploma of award which these boilers received at the World's Fair, and on another page are illustrations of the medal received. The printed list of testimonials as to the merits of this boiler show that it is held in high esteem by many users.

Edwards & Company, 144th street and Fourth avenue, New York city, have recently filled an order for an electro mechanical bell with a gong 30 inches in diameter. This is believed to be the largest bell of this kind ever made. This company also make a one-inch electric bell, as well as the intermediate sizes between this and the 30-inch size, thus forming a most complete line of electric bells. Edwards & Company are also manufacturing a very satisfactory type of X-ray apparatus, which is meeting with favor among experimenters.

Cahall boilers are illustrated and described thoroughly in a most complete catalogue just issued by the Cahall Sales Department, Bank of Commerce Building, Pittsburgh. The catalogue is printed on fine plate paper, the illustrations are of a high order and the binding is in cloth of a modern style. The mass of data on steam generation contained in the book should prove of great value to engineers and users of power. Thayer & Company, Incorporated, of New York, Boston and Philadelphia, are general eastern agents for Cahall boilers.

Among the large contracts for gas and electric light fixtures received by Messrs. McKenney & Waterbury, 181 Franklin street, Boston, the past week, were the Masonic Building, Newtonville, Mass.; First Parish Church, Dorchester, Mass.; St. Jean de Baptiste Church, Pawtucket, R. I.; Tarbox School Building, Lawrence, Mass.; Elks Building, Bangor, Me.; Music Hall Building, Gardner, Mass., and the Massachusetts Benefit Building, State street, Boston. This firm does a very large business, and its customers are always highly pleased with the artistic work sent out.

FOR SALE.

A large lot of first-class open cars, mounted on light-running trucks suitable for trail-cars, and easily adapted for motor-car service.

HUNTRESS & EWING,
No. 8 Oliver Street,
BOSTON, MASS.

WATER-POWER FOR SALE.

120 Horse-power Turbine Water wheel Wheel-house. Two-story brick building, 36x171 feet; also main line shafting. Power reliable. On two railroads. About four hours from New York and Boston.
Apply to
"R. E. H," Lock Box D,
WEST WINSTED, CONN.

WANTED—Position by an all-around electrician. One who has had six years practical and business experience in all branches, capable of installing and operating any piece of electrical apparatus, from a bell to an electric light or power station. Would like good position in any branch, or would travel for good company. Best of references. Address,
"BUSINESS,"
Care of ELECTRICAL REVIEW, New York.

WHITE-CROSBY COMPANY,
CONTRACTING ENGINEERS,
EQUITABLE BUILDING, BALTIMORE, MD.
New York Office, 29 Broadway.

ELECTRIC CONDENSERS.
WM. MARSHALL,
Manufacturer.
STANDARDS A SPECIALTY.
709 LEXINGTON AVENUE, NEW YORK.

WHITNEY ELECTRICAL INSTRUMENT CO., MANUFACTURERS OF
High-Grade Electrical Instruments of Every Description.
PENACOOK, N. H., U. S. A.

A NEW AND VALUABLE BOOK.

"Gas, Gasoline and Oil Vapor Engines," by Gardner D. Hiscox, M. E. Octavo, cloth, 350 pp., 220 engravings. Price, $3.50. Sent, postage free, on receipt of price, by Electrical Review Publishing Company, 41 Park Row, New York city.

This, the only American book on the subject, is designed for the general information of every one interested in this type of motive power and its adaptation to the increasing demand for a cheap and easily managed motor requiring no licensed engineer. The book treats of the theory and practice of gas, gasoline and oil engines, as designed and manufactured in the United States. It also contains chapters on horseless vehicles, electric lighting, marine propulsion, etc. In view of the rapidly increasing interest in isolated plants operated by gas engines, this book should enjoy a large sale among electrical engineers. Address,
ELECTRICAL REVIEW,
41 PARK ROW, NEW YORK.

ELECTRICITY
Mechanics; Architectural Drawing and Designing; Architecture; Mechanical Drawing; Steam Engineering (Stationary, Locomotive or Marine); Civil, Railroad, Bridge, Hydraulic and Municipal Engineering; Plumbing and Heating; Coal and Metal Mining; Prospecting, and the English Branches.
Until further notice experimental apparatus will be furnished free to students. Send for Free Circular and Book of Testimonials, stating the subject you wish to study, to
The International Correspondence Schools, B 1003, Scranton, Pa.
TAUGHT BY MAIL
THOROUGH
PRACTICAL

THE LEHIGH VALLEY
CREOSOTING CO.
WORKS, PERTH AMBOY, N. J.
Office, Rooms 136 and 137, 1 Broadway, NEW YORK.
Creosoted Lumber, Underground Conduits, Telegraph Poles, Piling and Ties Furnished.

STYLE "H" BELL.
PIVOTED ARMATURE.
DOUBLE ADJUSTMENT.
RELIABLE RINGER
Send for New Catalogue.
HUEBEL & MANGER,
MANUFACTURERS,
236-90 Graham St BROOKLYN, N. Y.

THE BRADY MAST-ARMS.
T. H. BRADY, New Britain, Conn., U. S. A.
Manufacturer of Mast-Arms, Pole and Swinging Hoods, House Brackets and other Specialties for Construction Work.—*Catalogues and Prices furnished on application.*

ROYCE & MAREAN,
DEALERS IN
Electrical Supplies,
WASHINGTON, D. C.

NEW BOOK
ON
ELECTRO-THERAPEUTICS
Valuable Contributions by Learned Men.

PROCEEDINGS OF THE BOSTON MEETING OF THE AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION.

SOME OF THE SUBJECTS:

"Meters," "Induction Coils," "Static Electricity," "Electrodes," "Generators and Controllers," "The Electric Light in Therapy," "Electricity Instead of Surgery," "Electricity in Diseases of the Throat and Nose," "In Diseases of the Larynx," "Accidents in the Use of Street Currents," "Direct Electrization of the Stomach," "Electricity in the Treatment of Apoplexy," "Electricity in Treatment of the Nerves," "Electricity in Treatment of Stricture," "Results in Eighty-Six Fibroid Cases," and many others.

HANDSOMELY BOUND VOLUME, $1.50,
LARGE READABLE TYPE.

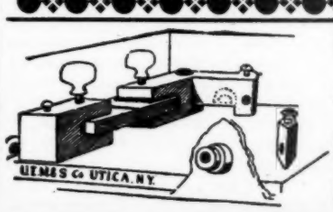
Only a limited edition and no reprint. Order of
ELECTRICAL REVIEW,
TIMES BUILDING, NEW YORK.

ELECTRIC PASSENGER BOATS
A PAYING INVESTMENT AT
STREET RAILWAY PARKS and PLEASURE RESORTS.

TRAFFIC PROMOTERS.
Stimulating Pleasure Riding.
Various Designs and Sizes.
Send for Special Catalogue.
THE ELECTRIC LAUNCH CO.,
MORRIS HEIGHTS, NEW YORK CITY.

Patented.

No. 11, Double Groove Pony Insulator.
HIGH INSULATION.
The most perfect Glass Insulator made is the Teat Insulator.
"The Teats on the lower rim of the petticoat attract the water on the outer and inner surfaces of the Insulator into drops. The water drops from these points on to the cross-arm, thereby preventing the moisture from creeping to the pin."
HEMINGRAY GLASS CO., Covington, Ky.
Factories, MUNCIE, IND.



LIGHTNING ARRESTER.
ARC-KNIFE SWITCH.
MAST-ARMS.
Write Us. Get Our Discounts.
Utica Electrical Manufacturing and Supply Co., UTICA, N. Y.

PARTRICK & CARTER CO.
125 SOUTH SECOND ST. PHILADELPHIA
MANUFACTURE GENERAL ELECTRIC SUPPLIES
ANNUNCIATORS
BURGLAR & FIRE ALARMS
SIGNAL GONGS-BELLS etc.

Electrical.... Patents.

[Specially reported for this journal by E. S. Duvall, solicitor of patents, Loan and Trust Building, Washington, D. C. Copies of any patent may be secured for 10 cents each.]

ISSUED MARCH 2, 1897.

577,872 Electrical car lighting; M. Moskowitz, Newark, N. J.

577,885 Electric car lighting; Courtland Skinner, Chicago, Ill.

577,911 Automatic telephone call device; E. P. Boland, New York, N. Y.—An automatic coin-operated telephone call device, comprising a box or casing, in which is placed a passage for coin, a pivotally supported receptacle which is adapted to receive said coin and to eject the same, a spring onto which said coin is adapted to roll, and another spring with which the first named spring is adapted to be brought in contact by said coin, and a battery or other suitable source of electrical supply which is in circuit with said springs and the central station.

577,912 Electric railway; S. G. Brosius, Baltimore, Md.—A car adapted to travel thereon, and provided with a propelling motor, positive and negative conductor rails for the electric current, a contact box provided with automatically adjustable contact bars, a plow adapted to be connected with said contact box, and in contact with said adjustable contact bars, and adapted to move in contact with said conductor rails to carry the electric current to and from said motor for propelling the car, and means for disengaging said plow from said contact box.

577,920 Telephone call register; W. A. Heckard and D. Ogden, Columbus, Ind.

577,921 Trolley catcher; T. Holahan, Rochester, N. Y.

577,950 Double pole reversing switch; H. A. Gorn, New York, N. Y.—Consists of oppositely arranged plates, carrying the circuit terminals and intermediate contact blocks, a rotating shaft carrying connecting contacts, means for operating the shaft manually, and automatic means for completing the movement of the shaft.

578,006 Table telephone apparatus; L. M. Errieson, Stockholm, Sweden—Consists of a rotating core, pole pieces and horseshoe magnets attached thereto, at each end, said magnets extending downwardly from the core, and having broadened and spreading base portions to serve as supporting feet.

578,016 Commutator brush; J. F. Kester, Buffalo, N. Y.—A commutator brush, consisting of a corrugated core and a wire gauze covering surrounding the core.

578,069 Electric motor; H. A. Stock, Millersburg, Pa.—An alternating current motor, all of whose field poles are at any instant of the same sign in combination with two sets of armature poles, which at any given instant are of opposite signs, and coils wound on all of the said poles, connected to a source of alternating current.

578,070 Electrode; A. E. Woolf, New York, N. Y.

578,077 Testing apparatus for electric automatic systems; C. Burgher, Newton, Mass.

578,101 Speaking tube attachment; E. C. Hess, Camden, N. J.—Comprises an extensible tubular section, arranged within the tube proper, with a space there between, a mouth piece on the tube proper and a receiver on the tubular section, adapted to be drawn within the mouth piece.

578,107 Electric lamp; M. M. Kohn, Chicago, Ill.—A case to contain an electric battery, a detachable cap for said case, a reflector on said cap, an electric lamp carried by said reflector, a switch on the cap, and contacts carried by the cap and by a permanent seal for the battery, automatically engaged with each other when the cap is attached to the case.

578,113 Message recording instrument; B. J. Noyes, Boston, Mass.

578,114 578,115 Electric signaling apparatus; B. J. Noyes, Boston, Mass.

$25.00, $15.00, $10.00.

PUZZLE

In Gold, will be paid to the three purchasers sending in the most solutions of this novel Egg Puzzle. Interests and amuses young and old. Requires patience & steady nerves. Send 15 cts. for Puzzle, (2 for 25 cts.) and learn how to secure a PRIZE.

Walter S. Coles, Neave Building, Cincinnati, Ohio.

Incandescent Lamp-Shade Holder.

A convenient shade holder for incandescent lamps, which adjusts itself to the various sizes of sockets, keeping the lamp in the center of the shade ring, is made by the Housatonic Company, Wallingford, Ct. The fastening of the holder is on the wedge principle and will not become loosened, and may be attached to the

INCANDESCENT LAMP-SHADE HOLDER.

Edison socket without removing the rubber or porcelain screw on the lower end, avoiding the objectionable clamping screw. These shade holders are made in ornamental designs, so as to be in harmony with the most elaborate fixtures.

The large plant of the Housatonic Company has been entirely rebuilt since its destruction by fire, and is now a thoroughly modern manufacturing plant.

Standardizing Lamp Sockets and Bases.

In his Interim Report No. 3, just issued, President Nicholls, of the National Electric Light Association, says:

At the close of my last Interim Report I referred to a meeting of lamp and socket manufacturers that I had called, to be held under the auspices of this association, to discuss the question of standardizing the incandescent lamp socket and lamp base, and stated:

"Whilst I am doubtful of any direct result towards the desired end from this first meeting, I am hopeful that we can enter the thin end of the wedge at least, and by sustained and persistent effort accomplish what we have in view."

I now have to advise you that a most successful and well attended meeting was held, accounts of which appeared in the electrical journals at the time, and that at the present good progress is being made, although some unexpected difficulties have arisen to delay a definite settlement. Late in December the National Board of Fire Underwriters, at a meeting held in New York city, amended the rule relating to sockets to read as follows:

"No portion of a lamp socket or lamp base, exposed to contact with outside objects, must be allowed to come into electrical contact with either of the conductors."

This amendment to the rules of the Fire Underwriters makes it necessary that any standard adopted should fulfill these requirements, and I propose calling another meeting at an early date, at which the committee appointed at the last meeting will report progress.

ITEMS OF INTEREST.

"Refrigeration" is the title of an unusually interesting pamphlet just issued by Westinghouse, Church, Kerr & Company, engineers, New York city. It illustrates and describes the company's machinery for ice-making and cold-storage. The arguments presented are practical and should be convincing.

The Cutter Electrical and Manufacturing Company, of Philadelphia, issued last week a red leaflet with the corner burned off and grimed with smoke. It read as follows:

Fire destroyed the power house of the Union Traction Company, Philadelphia, on Wednesday night, March 3. While the ruins were still smoking, an order for 165 1-T-E circuit-breakers, standard switchboard type, was placed with the Cutter Electrical and Manufacturing Company.

Delivery on account of this order was begun at once, and 117 circuit-breakers were delivered inside of 24 hours. Comment is unnecessary.

ELECTRIC LIGHT PLANT.

Tippecanoe City, Ohio, will receive bids until noon, March 26, 1897, for the erection of an ELECTRIC LIGHT PLANT, 60 to 90 kilowatts capacity, direct-current system. Specifications can be had by addressing

JOHN M. HAAGA,
Village Clerk.

Wanted—An Idea Who can think of some simple thing to patent? Protect your ideas; they may bring you wealth. Write JOHN WEDDERBURN & CO., Patent Attorneys, Washington, D. C., for their $1,800 prize offer and list of two hundred inventions wanted.

DYER & DRISCOLL,
PATENT SOLICITORS,
36 WALL STREET, N. Y.,

Have done all my patent soliciting work, both for this and foreign countries, continuously for the past fourteen years.

Thomas A. Edison

PATENTS.

TRADE MARKS.—DESIGNS.—COPYRIGHTS.

CAN YOU OBTAIN A PATENT?

Send me a model or drawing of your invention, and a description, and I will examine same and advise you promptly. My fees are moderate in all Patent matters, and I can obtain a Patent in the shortest possible time.

All Patents taken out through me are given special notice in the leading journals of the country, thus bringing same widely before the public without cost to inventor.

REFERENCES: "Electrical Review," New York; Paul Cromlein, Teller Lincoln National Bank, Washington, D. C.; Judge Geo. D. Parker, Berkley, Va.; Second National Bank, Washington, D. C.; E. K. Leech, U. S. Mint, Philadelphia, Pa.; W. F. Newell, Manager and Secretary Water Works Olympia, Oregon.

EDW. S. DUVALL, Loan and Trust Bldg.,
Solicitor of Patents. WASHINGTON, D. C.

WANTED—SITUATION in the electrical business by a young man 19 years old. Graduate of Packard's Business College, and have had practical experience in ELECTRIC LIGHT and POWER STATIONS.

Good references and moderate salary, with prospect of advancement.

Address

"W. C. K.,"
96 Prince Street, NEW YORK.

W. R. OSTRANDER & CO.,
22 DEY STREET,
Manufacturers of
SPEAKING TUBES, WHISTLES, ANNUNCIATORS.
Electric and Mechanical Bells.
FACTORY,
De Kalb Ave.,
BROOKLYN.

Send for Illustrated Catalogue.

PATENT OFFICE.

U. S. and Foreign PATENTS.
ENGINEERING Specifications.
Patent Suits and Interferences.
Expert Testimony.
Agreements and Assignments.
Tests, Reports, Opinions.
Trade-marks and Designs.
Working Drawings.
Opinions on Infringement, etc.
Examinations, etc.

EDWARD P. THOMPSON, M. E.,
Solicitor of Patents. Mem. Amer. So. Mech. Eng. and Mem. Amer. Inst. Electrical Eng. Author, "Inventing as a Science and an Art," and "Roentgen Rays and Phenomena of the Anode and Cathode." 14 years' experience.

PROF. WM. A. ANTHONY,
Electrical and Scientific Expert For 15 years of Cornell Univ. and Past Pres. Amer. Inst. Electrical Eng.

ALFRED C. COURSEN,
Counsellor at Law.
Address
119 NASSAU, cor. BEEKMAN ST., NEW YORK.

MASTER WORKMAN,

who has successfully been engaged for 15 years in the manufacture of battery and electric-light carbon, desires to settle in the United States.

Proposals should be addressed to H. S., 6143,

RUDOLF MOSSE,
Hamburg, Germany.

McINTIRE'S PATENT
CONNECTORS AND TERMINALS.

Special Connectors for HARD-DRAWN COPPER WIRE, *All Sizes.*
Fused Wire, Fused Links and Strips.
The C. McINTIRE CO., 13 & 15 Franklin Street,
Newark, N. J.

No. 4 BULLS-EYE . . $12.00.

For 4x5 Pictures.

As Simple as a Pocket Kodak.

Loads in daylight with our light-proof Film Cartridges. Fitted with achromatic lens, improved shutter and set of three stops. Handsome finish.

EASTMAN KODAK COMPANY,
Booklet Free. Rochester, N. Y.

CLEARANCE SALE
OF
SHELF-WORN BOOKS

	List.	Net.
Atkinson. "Elements of Static Electricity"	$1 50	$0 60
Angell. "Elements of Magnetism and Electricity"	1 00	0 60
Benjamin. "Age of Electricity"	2 00	1 00
Bottone. "Electrical Instrument Making for Amateurs"	0 75	0 40
Bottone. "Electric Bells and All About Them"	0 50	0 40
Bottone. "A Guide to Electric Lighting"	0 75	0 40
Dolbear. "The Telephone, with Directions for Making"	0 50	0 40
Cumming. "Electricity Treated Experimentally"	1 50	0 50
Gordon. "School Electricity"	2 00	1 50
Fiske. "Electricity and Electrical Engineering"	2 50	1 00
Haskins. "Transformers: Theory, Practice and Application"	1 25	0 75
Houston. "Electrical Dictionary," old	——	1 00
Prindle. "Electric Railway of To-day"	0 50	0 25
Hamilton. "Origin of Energy"	2 00	0 75
Trevert. "Electricity and Its Recent Applications"	2 00	1 00
Urquhart. "Dynamo Construction"	3 00	1 00
Slater. "Telegraphic Code"	3 00	1 00
Harris. "Rudimentary Magnetism"	1 80	0 80
Harris "Rudimentary Electricity"	0 60	0 30
Munro. "Electricity and Its Uses"	1 40	1 00
Noad. "The Students' Text-Book of Electricity"	4 00	2 00
Kapp. "Alternate-Current Machinery"	0 50	0 30
Barnard. "First Steps in Electricity"	0 75	0 50
Grimshaw. "Hints to Power Users"	1 00	0 60
Stephen. "Wrinkles in Electric Lighting"	1 00	0 75

Address
ELECTRICAL REVIEW,
Times Building, New York.